United States Department of Agriculture

Economic Research Service

Foreign Agricultural Economic Report Number 170

# The Role of Wheat in Indonesia's Food System

Stephen L. Magiera

**The Role of Wheat in Indonesia's Food System.** Stephen L. Magiera, International Economics Division, Economic Research Service, U.S. Department of Agriculture, Foreign Agricultural Economic Report No. 170.

## Abstract

Wheat flour consumption in Indonesia is highly responsive to income growth and changes in wheat and rice prices. Indonesian wheat imports could reach 1.9 million metric tons or more in 1985, depending upon whether the Government pursues an active policy of encouraging imports. The U.S. share of that market could be more than 1 million tons. Raising the price of rice is the most direct means by which the Indonesian Government can both lower the cost of imported food and reduce the country's reliance on the international rice market. The study examines recent trends in Indonesian wheat imports, current marketing and price mechanisms, and Government policy toward wheat.

Key words: Indonesia, wheat, imports, consumption, marketing, policy, income elasticity, price elasticities.

Washington, D.C. 20250 December 1981

## Acknowledgments

The author thanks Thomas Slayton of USDA and Steve Tabor of Cornell University for helpful suggestions, Amar Siamwalla of the International Food Policy Research Institute for suggestions on the policy section, Leslie Ross and Michael Herlihy for statistical support, and Michael Lopez, Don Sillers, Gary Ender, William Coyle, William Kost, and the many other reviewers of earlier drafts. Projections and policy conclusions in this report are based on analyses undertaken by the Economic Research Service.

## Currency Exchange Rates

U.S. $1 = 378 rupiah, January 1971-July 1971
U.S. $1 = 415 rupiah, August 1971-October 1978
U.S. $1 = 625 rupiah, November 1978-present

## Summary

Indonesian imports of wheat and wheat products rose from a yearly average of only 100,000 metric tons (grain equivalent) in the midsixties to nearly 1.5 million in 1980. This study projects 1985 Indonesian wheat imports at 1.9 million metric tons, half of which could come from the United States.

Wheat is an important element of Indonesia's food stabilization program, filling about 30 percent of the country's imported cereal needs. Nearly all wheat is bought commercially, in contrast to the years prior to 1972 when Indonesia relied almost totally on wheat sold on concessional terms. The U.S. share of the Indonesian market fell in the midseventies because of cutbacks in P.L. 480 shipments and because of stiff competition from Australia in the Indonesian commercial market. Only recently have favorable price developments led to a recovery in the U.S. trade share.

Indonesian wheat imports will likely reach 1.9 million metric tons in 1985 if the Government follows a neutral import policy of keeping real wheat and rice prices constant. The U.S. share is likely to be between 750,000 and 1.1 million metric tons. Imports will be greater if the Government actively encourages wheat imports by lowering the domestic price of wheat or raising the domestic price of rice. The most direct means of both reducing the country's reliance on the international rice market and reducing the cost of imported food would be to increase the domestic price of rice. This would, however, run counter to Government efforts to control inflation. Whether lowering the wheat price leads to lower imported food costs depends on the responsiveness of international rice prices to changes in Indonesian rice imports.

Total calorie intake from wheat and wheat-based products is quite small and well below that of the three main Indonesian staples: rice, corn, and cassava. Wheat flour products are consumed primarily by high-income groups in urban areas as an occasional food, especially on holidays and other special occa-

sions. Rice is the most important staple for all segments of the population, while relatively more corn and cassava are consumed by low-income groups and those in rural areas. Flour consumption, however, is likely to rise rapidly with incomes and is very responsive to changes in its retail price and the price of rice. No significant substitution between flour and other non-rice foods could be found.

Indonesia opened three privately owned flour mills in the early seventies. The processing and storage capacity of these mills has risen according to the country's need for flour. Consideration is being given to 1982/83 mill expansions which would commit Indonesia to further increases in wheat imports.

BULOG, the Indonesian national grain authority, controls wheat imports, wheat transfers to the mills, and the subsequent sale of flour to distributors. The price at which BULOG releases grain to the mills and the price at which flour is sold to distributors are also Government controlled. Retail flour prices, however, move freely according to local market conditions, with the mill selling price providing a floor. But, the Government can influence these prices through its control of flour allocations. Domestic prices are fairly independent of international prices and reflect Government efforts to provide wheat as an alternative calorie source at a price on par with that of rice. This has at times involved a substantial subsidy since the price at which BULOG releases grain to the mills is often below the world price of wheat.

## Contents



## Tables and Charts

## Tables and Charts

# The Role of Wheat in Indonesia's Food System

## Stephen L. Magiera

### Introduction

While rice is Indonesia's major cereal, its wheat grain imports are rising dramatically. The United States, although facing stiff competition from Australia, will likely be an important commercial source for these imports. Wheat flour, imported for a long time by Indonesia, is now available to consumers, primarily urban, as an alternative to other staple foods produced in the country. Average calorie intake from wheat, while well below that from the three main Indonesian staples — rice, corn, and cassava — approaches that of several other minor but traditional nonrice foods.

Research on the Indonesian food sector has concentrated on staples produced in the country and has given little attention to wheat, which is not domestically produced. This report fills in some of this information void by reviewing past trends in wheat imports, the U.S. market in Indonesia, marketing mechanisms for wheat, and the means by which Indonesian wheat policy is implemented.

This report also provides parameters needed for wheat import projections and policy analysis. The Indonesian Government's food stabilization program has shifted over the past decade from one concentrated almost exclusively on achieving rice self-sufficiency toward one taking a more comprehensive view of the entire food sector. Indonesia will likely continue to be a cereal deficit country and there is an apparent commitment to a continuing role for wheat in meeting that deficit. This commitment has generated debate about the precise role wheat should play and questions as to the future level of imports. This report, thus, provides projections for Indonesian wheat imports to 1985 and examines mechanisms by which Indonesia can reduce the cost of imported food. The latter is but one of many issues facing Indonesian policymakers. Other policy questions require a comprehensive analysis in which rice and other major food staples are included.

## Trends in Indonesian Wheat Imports

Indonesian wheat flour imports began a rapid increase in the late sixties. Such imports, although fluctuating widely, averaged 175,000 tons per year (entire text refers to metric tons of grain equivalent unless otherwise stated) during the fifties and never climbed above 275,000 tons (table 1).[1] Flour imports then fell sharply during the political and economic turmoil of the midsixties, averaging only 100,000 tons a year between 1961 and 1967, but recovered late in the decade with the increased availability of flour on concessional terms. These terms were granted in order to help control the tremendous inflationary pressure on food prices experienced during that period and to provide the Indonesian Government with much needed development funds. Approximately 89 percent of all flour imports, which averaged 500,000 tons annually between 1968 and 1973 (table 1), were available on a concessional basis during those years, compared with only 26 percent during the previous 3 years (table 2).

The rising trend in wheat imports continued during the seventies as imports averaged 950,000 tons a year between 1973 and 1978 and climbed to nearly 1.5 million tons in 1980. The seventies also saw two significant changes in the way wheat was imported. First, after the opening of three wheat flour mills in 1971 and 1972, only small quantities of wheat flour were imported as Indonesia switched almost entirely to grain imports. Second, while wheat continued to be imported on a concessional basis, Indonesia began making substantial commercial purchases of

[1]There are a variety of different data sources on Indonesian wheat imports. We have, with exception of the last 3 years, relied on the Biro Pusat Statistik (Indonesian Central Bureau of Statistics) series because it is readily available on a calendar year basis for a long historical period. Since 1977, BPS wheat import figures have been well below those reported in other sources and we have therefore used data from the U.S. Agricultural Attache based on BULOG trade estimates. BULOG data are generally considered more reliable than BPS data but are only available for the past decade and on a split-year basis. Data gathered by the International Wheat Council on recorded country exports to Indonesia and Indonesian wheat imports are presented in table 4 and appendix table 1, respectively. The data series are compared over different time periods in appendix table 2.

wheat. Commercially purchased wheat rose from only 11 percent of total wheat imports between 1968/69 and 1972/73 to 76 percent between 1973/74 and 1977/78.

**Table 1 — Indonesian wheat imports**

| Year | Wheat | Wheat flour | Total | Year | Wheat | Wheat flour | Total |
|---|---|---|---|---|---|---|---|
| | *1,000 metric tons*[1] | | | | *1,000 metric tons*[1] | | |
| 1950 | — | 77 | 77 | 1965 | — | 45 | 45 |
| 1951 | — | 177 | 177 | 1966 | — | 66 | 66 |
| 1952 | — | 202 | 202 | 1967 | — | 212 | 212 |
| 1953 | — | 191 | 191 | 1968 | — | 510 | 510 |
| 1954 | — | 151 | 151 | 1969 | — | 408 | 408 |
| 1955 | — | 167 | 167 | 1970 | — | 557 | 557 |
| 1956 | — | 274 | 274 | 1971 | 88 | 532 | 620 |
| 1957 | — | 223 | 223 | 1972 | 407 | 24 | 431 |
| 1958 | — | 135 | 135 | 1973 | 663 | 29 | 692 |
| 1959 | — | 130 | 130 | 1974 | 672 | 113 | 786 |
| 1960 | — | 197 | 197 | 1975 | 717 | 14 | 731 |
| 1961 | — | 153 | 153 | 1976 | 965 | 3 | 968 |
| 1962 | — | 87 | 87 | 1977 | [2]1,070 | 5 | 1,075 |
| 1963 | — | 101 | 101 | 1978 | 1,154 | N.A. | 1,154 |
| 1964 | — | 44 | 44 | 1979 | 1,209 | N.A. | 1,209 |
| | | | | 1980 | 1,444 | 30 | 1,474 |

N.A. = Not available.
— = No imports.

[1]Measured in grain equivalents: 1 kilogram wheat grain = 0.72 kilogram wheat flour except in 1980 when a 74-percent extraction rate is used.

[2]Beginning in 1977, BPS estimates of Indonesian wheat imports are considerably below those reported by other sources. In 1977, for example, BPS reports imports of 753,000 tons compared to reported exports to Indonesia by the United States, Canada, and Australia totalling 971,000 tons. We have thus used import data supplied by the U.S. Agricultural Attache, Jakarta, for 1977 to 1980.

Sources:
- 1950-63 — *Indonesia Facts and Figures*, Nugroho, 1967.
- 1963-67 — *Statistical Pocket Book of Indonesia*, Biro Pusat Statistik, various issues.
- 1968-76 — *Neraca Bahan Makanan di Indonesia, 1968-1977*, Biro Pusat Statistik, various issues.
- 1977-80 — U.S. Agricultural Attache, Jakarta. Figures include flour imports where not listed separately.

Indonesia's shift from concessional to commercial wheat purchases coincided with a decline in the U.S. share of the Indonesian market. This was caused in part by a hardening of P.L. 480 terms. In the late sixties, the United States had attempted to

**Table 2 — Indonesian wheat food aid**

| Year | Imports[1] | Concessional | Concessional as percentage of total |
|---|---|---|---|
| | *1,000 metric tons*[2] | | *Percent* |
| 1965/66 | 55 | 18 | 33 |
| 1966/67 | 89 | 16 | 18 |
| 1967/68 | 333 | 92 | 28 |
| 1965/66-1967/68 | 477 | 126 | 26 |
| 1968/69 | 488 | 386 | 79 |
| 1969/70 | 741 | 692 | 93 |
| 1970/71 | 703 | 671 | 95 |
| 1971/72 | 531 | 478 | 90 |
| 1972/73 | 813 | 684 | 84 |
| 1968/69-1972/73 | 3,276 | 2,911 | 89 |
| 1973/74 | 702 | 194 | 28 |
| 1974/75 | 898 | 150 | 17 |
| 1975/76 | 846 | 70 | 8 |
| 1976/77 | 1,084 | 367 | 34 |
| 1977/78 | 1,075 | 302 | 28 |
| 1973/74-1977/78 | 4,605 | 1,083 | 24 |
| 1978/79 | 1,239 | 266 | 21 |
| 1979/80 | 1,195 | 153 | 13 |

[1]Reported Indonesian imports do not match those obtained from other sources. Although this may be confusing to the reader, the series above are used because they allow a comparison between commercial and concessional sales.
[2]Grain equivalent.

Sources:
- 1965/66-1979 — *World Wheat Statistics*, International Wheat Council, various issues. July/June year.
- 1979/80 — U.S. Agricultural Attache, Jakarta.

put the financing of concessional wheat purchases under P.L. 480, Title I, on the softest possible basis. No initial or currency-use payments were required, amortization periods were set at the maximum of 40 years with a 10-year grace period on principal payments, and there were no usual marketing requirements.[2] Between 1968/69 and 1972/73, total U.S. wheat exports to Indonesia averaged 344,000 tons per year or 61 percent of the Indonesian market (table 3). During the same period, P.L. 480 shipments averaged about 325,000 tons per year, indicating that nearly all the U.S. wheat sales to Indonesia were concessional.

The terms for financing P.L. 480, Title I, were hardened when Indonesian petroleum exports became an important source of earnings and following world food shortages in 1973. Amortization periods were shortened to 25 years with 6-year grace periods and an initial payment of 15 percent and a currency-use payment of 10 percent were required, as were usual marketing arrangements. P.L. 480, Title I, shipments thus dropped to negligible levels in 1973 and although recovering in 1976, they have not reached previous levels (table 3). From 1973/74 to 1977/78, U.S. concessional exports to Indonesia averaged 114,000 tons a year while overall annual U.S. exports to Indonesia remained at about 350,000 tons. The overall U.S. share of the market thus dropped to about 39 percent, as American sales remained static in an expanding Indonesian market.

Major classes of U.S. wheat sold in Indonesia are the Dark Northern Springs, Hard Red Winters, and Western White. Dark Northern Springs, which comprise the largest U.S. market in Indonesia, are blended with Australian wheat in order to strengthen bread and general-purpose flours. Hard Red Winter wheats have only recently been introduced into Indonesia and, while generally used for blending, are sometimes milled directly into general-purpose flour. Western White, which in recent years has made up about 20 percent of the U.S. wheat

[2]The initial and currency-use payments refer to those portions of the P.L. 480 purchase price payable upon delivery of the commodity in U.S. dollars and local currency, respectively. The usual marketing requirement refers to the stipulation that the P.L. 480 recipient continue to import from its normal commercial sources.

market in Indonesia, is used in making pastries and cookies and for blending (*13*). (Italicized numerals in parentheses refer to items in the References section.)

All classes of U.S. wheat face stiff competition from Australian wheat, primarily Australian Standard White which accounts for about 70 percent of that country's wheat market in Indone-

**Table 3 — U.S. total and concessional wheat exports to Indonesia**

| Year | Total | Concessional | Year | Total | Concessional |
|---|---|---|---|---|---|
| | *1,000 metric tons*[1] | | | *1,000 metric tons*[1] | |
| 1956/57 | 109 | 82 | 1968/69 | 203 | 195 |
| 1957/58 | 3 | 3 | 1969/70 | 426 | [2]437 |
| 1958/59 | 0 | 0 | 1970/71 | 416 | [2]434 |
| 1959/60 | 117 | 95 | 1971/72 | 182 | 181 |
| | | | 1972/73 | 495 | 376 |
| 1960/61 | 21 | 0 | 1968/69-1972/73 | 1,722 | 1,623 |
| 1961/62 | 76 | [2]83 | | | |
| 1962/63 | 80 | [2]91 | 1973/74 | 315 | 30 |
| 1963/64 | 14 | 1 | 1974/75 | 98 | 35 |
| 1964/65 | 1 | 0 | 1975/76 | 537 | 13 |
| | | | 1976/77 | 390 | 260 |
| 1965/66 | 2 | 1 | 1977/78 | 417 | 232 |
| 1966/67 | 1 | 1 | 1973/74-1977/78 | 1,757 | 570 |
| 1967/68 | 2 | 3 | | | |
| 1955/56-1967/68 | 452 | 360 | 1978/79 | 706 | 230 |
| | | | 1979/80 | N.A. | N.A. |

N.A. = Not available.

[1]Grain equivalent.
[2]P.L. 480 shipments may exceed total U.S. exports in some years. The data have been obtained from different sources and the ambiguity is likely to arise because of differences in the timing of shipments.

Sources:
- U.S. exports, 1955/56-1977/78 — *World Wheat Statistics*, International Wheat Council, various issues. July/June year.
- Concessional, 1955/56-1972/73 — *U.S. Agricultural Exports under Public Law 480*, ERS-Foreign 395, Economic Research Service, U.S. Dept. Agr., Oct. 1974. P.L. 480 shipments for July/June year not including bulgar.
- Concessional, 1973/74-1978/79 — "Record of Operations of Member Countries," International Wheat Council, various issues. July/June year.

sia. Australia expanded its Indonesian wheat market share from an average of 15 percent to 48 percent over the past decade (table 4). There are two principal factors behind this increase. First, Australia has a comparative advantage in the Indonesian market due to lower transportation costs. In late 1979, for example, the cost of bulk shipping between Australia and Indonesia was $22-$25 per long ton compared with $35-$38 per long ton between the United States and Indonesia. The difference was about 10 percent of the U.S. f.o.b. price for Dark Northern Springs and was approximately double the difference of 1 year earlier (*13*). Second, the Australian market share depends much less on food aid and, therefore, improves with increased Indonesian commercial purchases.

But, the U.S. market share has improved dramatically in the last 2 years. Of total Indonesian wheat grain and flour imports amounting to 1.47 million tons in 1980, for example, the United States shipped over 800,000 tons and gained 55 percent of the Indonesian market. The improvement is attributed to a decline in the relative price of U.S. wheat vis-a-vis Australian wheat and a shift in Indonesian preferences toward U.S. wheats.

Other minor suppliers of wheat to Indonesia are Canada and the European Community. The EC's market share in Indonesia, which depends almost totally on grants, has been halved in recent years, while Canada's share has been fairly stable. The two regions combined accounted for only 12 percent of the Indonesian market between 1973/74 and 1977/78.

## Wheat Marketing and Processing

Control of Indonesia's wheat flour imports was transferred to Government agencies in the late sixties when flour emerged as an important food commodity. Until 1972, imports were handled by the Department of Trade and marketed through syndicates at a Government-determined price. The syndicates paid for the flour by placing a deposit in a special account of the Ministry of Finance. Since most of the wheat flour was at that time imported on a concessional or grant basis, proceeds from

**Table 4 — Wheat exports to Indonesia and country shares**

| Year | Total | United States | Australia | European Community | Canada |
|---|---|---|---|---|---|
| | *1,000 metric tons*[1] | | *Percent* | | |
| 1953/54 | 199 | 13 | 87 | — | — |
| 1954/55 | 130 | 8 | 92 | — | — |
| 1955/56 | 250 | 10 | 90 | — | — |
| 1956/57 | 255 | 43 | 57 | — | — |
| 1957/58 | 151 | 2 | 53 | 45 | — |
| 1958/59 | 118 | — | 41 | 59 | — |
| 1959/60 | 198 | 59 | 20 | 17 | 4 |
| 1960/61 | 162 | 13 | 73 | 10 | 4 |
| 1961/62 | 116 | 65 | 23 | 2 | 10 |
| 1962/63 | 92 | 87 | 8 | — | 4 |
| 1963/64 | 28 | 50 | 21 | 21 | — |
| 1964/65 | 39 | 3 | 38 | 15 | 5 |
| 1965/66 | 41 | 5 | 10 | 41 | — |
| 1966/67 | 65 | 2 | 46 | 6 | 5 |
| 1967/68 | 214 | 1 | 39 | 9 | — |
| 1968/69 | 343 | 59 | 22 | 14 | 5 |
| 1969/70 | 675 | 63 | 11 | 18 | 3 |
| 1970/71 | 634 | 66 | 11 | 13 | 5 |
| 1971/72 | 456 | 40 | 25 | 26 | 8 |
| 1972/73 | 699 | 71 | 11 | 11 | 7 |
| 1968/69-1972/73 | 2,807 | 61 | 15 | 16 | 6 |
| 1973/74 | 618 | 51 | 22 | 12 | 12 |
| 1974/75 | 829 | 12 | 72 | 6 | 9 |
| 1975/76 | 921 | 58 | 34 | 5 | 2 |
| 1976/77 | 1,084 | 36 | 50 | — | 14 |
| 1977/78 | 1,021 | 41 | 56 | 3 | — |
| 1973/74-1977/78 | 4,473 | 39 | 48 | 5 | 7 |
| 1978/79 | 1,238 | 57 | 42 | 1 | — |

— = Negligible.

[1]Grain equivalent.

Source: *World Wheat Statistics*, International Wheat Council, various issues. July/June marketing year. Derived from reported exports to Indonesia by country.

flour sales to syndicates were available to the Government and were ultimately placed in its development budget after ocean freight charges had been paid. Profits of the syndicates were determined by transportation costs and by the retail price of wheat flour which was free to move according to local market conditions (*12*).

Several changes in the wheat marketing system have occurred since the early seventies. The first of three privately owned flour mills, the Bogasari mill in Jakarta, became operational in 1971. Two more mills, the Bogasari mill in Surabaya and the wholly Singapore-owned Prima mill in Ujung Pandang, South Sulawesi, opened in 1972. The initial combined processing capacity of these mills was approximately 550,000 tons of wheat flour per year. This capacity has since risen, according to the country's need for flour, to nearly 1.3 million tons per year (based on 300 milling days a year). The mills also have a combined grain and flour storage capacity of over 325,000 tons. Normal operating stocks in recent years have been about 200,000 tons of grain and 40,000 tons of flour, with the former amounting to a 2-month grain supply or from 15 to 20 percent of grain imports.

The Bogasari and Prima mills each market three types of flour under their own brand names. General-purpose flour is the most commonly used by the processing industry. The single exception is bread for which hard flour is the primary flour ingredient. Hard flour has a more limited distribution and also commands a slight price premium over general-purpose flour. Soft flour makes up only a small portion of the market and is used only in combination with other types of flour, primarily in making cookies. It is seldom sold on the retail market.

Wheat bran, the major byproduct of the milling industry and an important source of earnings, is sold as animal feed in Indonesia and is exported. Production figures for bran are not available; but, assuming a 26-percent bran extraction rate, about 310,000 tons of wheat bran and other byproducts would have

been produced in Indonesia in 1979.[3] Indonesia exported 180,000 tons of bran and 405,000 tons of other cereal residues at a total f.o.b. value of $42.5 million in 1979, according to BPS trade statistics. A detailed breakdown of these exports by type of cereal is not available (rice bran exports, for example, could be important), but most wheat bran produced in Indonesia is apparently exported, primarily to Singapore and to the EC.

The Government plans to continue wheat grain imports in the eighties. Consideration is now being given to 1982/83 expansions in the two Bogasari mills, increased grain storage capacity, and increased port handling facilities in Jakarta. Milling capacity of the Bogasari Jakarta mill, which expanded from 2,000 to 3,100 tons per day in 1980, would expand to 5,000 tons per day, while the Bogasari Surabaya mill would expand from 1,800 to 3,300 tons per day. The Bogasari Jakarta mill often runs close to full capacity, milling 355 days per year. Only the Prima mill, with a daily capacity of about 1,000 tons, frequently has excess capacity. Prima can normally fill its marketing requirements utilizing 35 percent of its capacity.

Control of wheat imports was transferred in 1972 from the Department of Trade to BULOG, the Indonesian national grain authority and the Government agency now responsible for the distribution of rice, wheat, and sugar. BULOG's objectives regarding wheat distribution are to stabilize flour prices and to synchronize grain shipments relative to mill production needs and stock positions. Mills are supposed to sell their flour back to BULOG; but, they in fact turn flour directly over to local, licensed distributors on the basis of delivery orders issued by BULOG. Marketing regions for the Bogasari mills in Jakarta and Surabaya are Java, Sumatra, and Kalimantan; for the Prima mill in Ujung Pandang, they are Sulawesi, Bali, and the Eastern Islands. These marketing districts are fixed; but in exceptional circumstances, flour is transferred from one region to another in order to alleviate tight supplies. The most recent instance of

[3] A 74-percent flour extraction rate is now used in setting the Indonesian mill fee structure. It is not known to what if any extent flour mills in Indonesia vary their flour extraction rates according to relative flour-bran prices.

this was in 1980 when Prima received special allocations of grain for processing and shipment into the Bogasari marketing districts during a peak holiday period.

Distributors handling flour are appointed by BULOG and are effectively under its control. They consist of private traders, who are members of the Association of Sugar and Flour Distributors, and cooperatives, such as the Jakarta Bread Entrepreneurs Cooperative and Village Cooperative Centers. Individual marketing territories and allocations of flour are fixed by BULOG, with the latter determined by the normal flow of flour through each distributor's market. Distributors have some control over their inventory and pricing decisions, however, and this has led to periods of speculative behavior. BULOG reviews allocations on a monthly basis and, to counter such speculation, can revoke a distributorship or change a distributor's allocation. On occasion, BULOG has also threatened to confiscate speculative stocks.

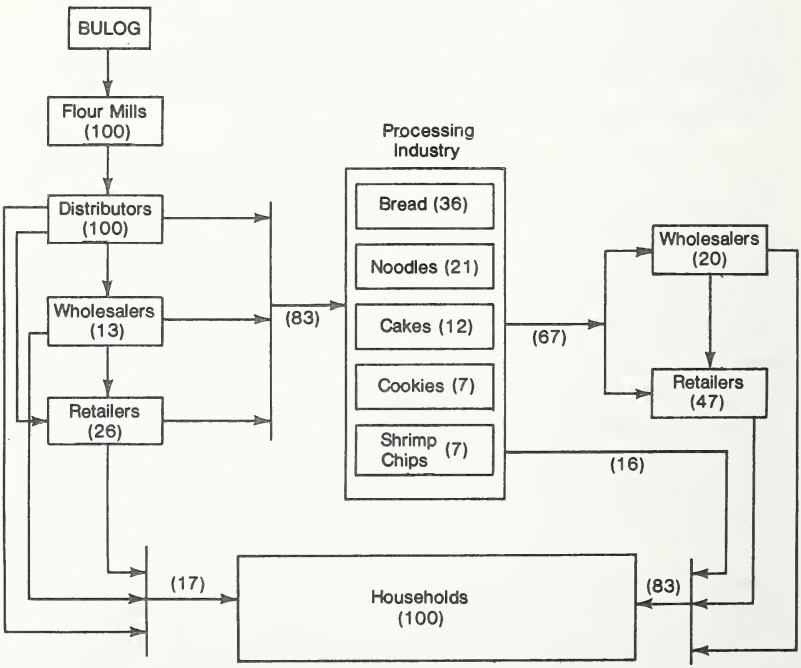
Flour passes from distributors through an extended marketing chain before reaching consumers as flour or flour-based products (fig. 1).[4] Although most flour handled by distributors is sold directly to the processing industry, a substantial amount also flows to wholesalers or directly to the retail market. Flour wholesalers and retailers are generally small, individually owned enterprises which also market other basic foodstuffs. While distributors tend to deal mainly with large processors, wholesalers and retailers sell to smaller processors, to consumers, and among themselves. They are particularly important elements in the marketing chain since small processors, as well as consumers, obtain flour exclusively from them.[5]

[4]Much of this report's information on marketing channels and consumption of flour products is based on a survey by the Pan Asia Research and Communications Service of Jakarta (9). This survey was conducted in 1980 in six Indonesian cities: Yogyakarta, Klaten, Surabaya, Sidoarjo, Malang, and Medan. Respondents to the survey consisted of 172 households with 1,176 members, 104 processors, and 37 distributors, wholesalers, and retailers.

[5]Marketing channels in figure 1 are based on flour sales by traders rather than purchases by the processing industry. Survey results on flour purchases by the processing industry seem to imply that relatively more flour is sold through wholesalers than is indicated in figure 1.

Sharply increasing wheat imports have led to a rapid expansion of the Indonesian processing industry over the past decade. The industry consists mainly of household enterprises or small labor-intensive firms with fewer than 20 employees. Such firms are prevalent in the manufacturing of bread, cakes, and the wide range of snacks consumed in Indonesia. Because these products have marketing areas extending only to the town of production and surrounding areas, they are sold mainly to the retail market, which includes retail food stores and street vendors, or directly to consumers. The few large, mechanized

**Figure 1: Indonesian marketing channels for flour and processed flour products**




Note: Excludes flour sold through cooperatives and flour sold to restaurants, industrial processors, and other minor processors. Numbers in parentheses are rough estimates of the percentage of flour handled by each marketing agent.

Source: Estimates based on a recent survey by the Pan Asia Research and Communications Service of Jakarta (9).

processors in Indonesia are more prevalent in cookie and noodle manufacturing. Cookies, in particular, are marketed over large areas, extending to the provincial or national level. They are most often sold through wholesalers.

## Wheat Pricing and Policy

The price at which BULOG sells grain to the flour mills and the wholesale price for flour sold by the mills to distributors are controlled by the Government. While BULOG's selling or surrender price for wheat grain is the same for all qualities, the mills' selling price for flour varies according to type of flour, with bread flour having a slightly higher price than either general-purpose flour or soft flour. Price changes are generally made no more than once a year and most often occur at the beginning of the Indonesian fiscal year in April. Decisions on such changes receive input from several Government agencies, but are primarily the responsibility of BULOG.

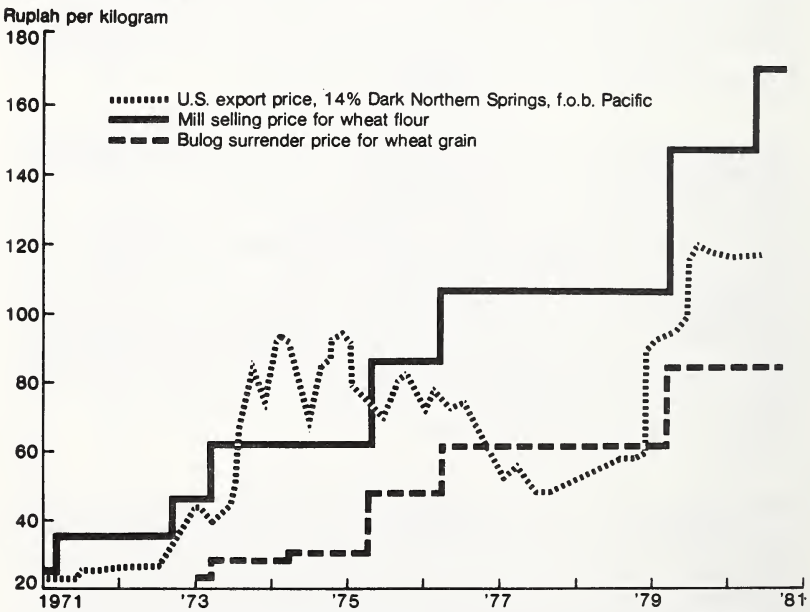
The retail price of wheat flour is free to move according to local market conditions, as was the case before BULOG took control of wheat imports. Actual prices reflect the Government-determined mill selling price, transportation and handling costs from the mills, local demand, and, at times, speculative behavior on the part of distributors. Several of the prices which may influence the price of flour are included in figures 2 and 3. These include the price of medium quality rice, which will be shown to be a strong substitute for wheat, the various mill prices, and international prices.

Flour prices moved up dramatically during the 1973 commodity price boom, but the Indonesian market is well insulated from fluctuations in international prices (fig. 2). Domestic rice and wheat flour prices, on the other hand, have moved in close unison (fig. 3); the correlation between monthly prices for the years 1969 to 1979 is 0.98. This reflects not only substitution between the commodities but also, and more importantly, the Indonesian Government's efforts to provide wheat as an

alternative calorie source, especially during periods of rising food prices. Although retail flour prices are market determined, the Government can influence these prices through its market allocations of flour.

Reliance on wheat imports for food price stabilization would seem to run counter to the Government's long-range goal of food self-sufficiency. Wheat will probably remain an imported grain since wheat trials in Indonesia indicate an extremely limited production potential. Current policy, however, favors reducing Indonesia's dependence on rice imports. Indonesia has recently purchased as much as 20 percent of the rice traded internationally despite successes in increasing rice production. Since

**Figure 2: Indonesian wheat policy prices and U.S. export prices**




U.S. $1.00 = 378 rupiah, January 1971 - July 1971
= 415 rupiah, August 1971.- October 1978
= 625 rupiah, November 1978 - October 1980

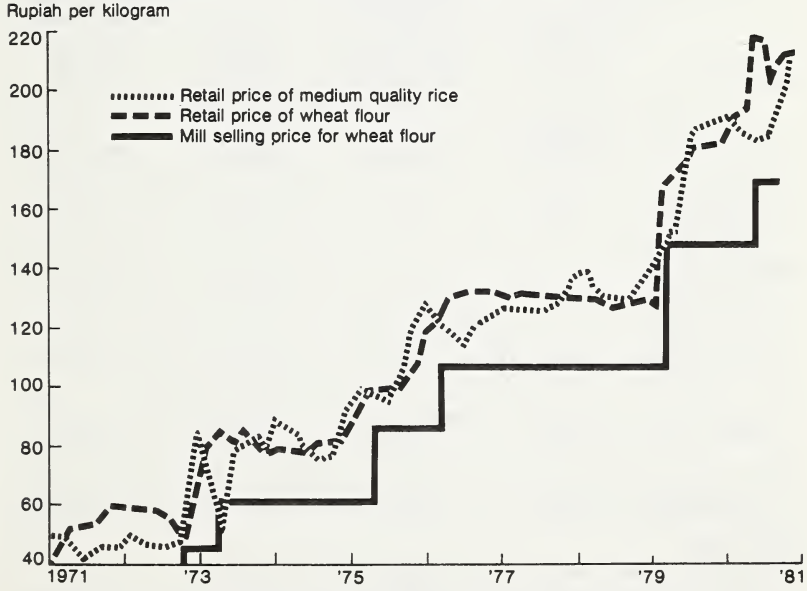
Source: International Wheat Council and BULOG

wheat is more widely traded than is rice and at a cheaper price per calorie, Indonesia has attempted to reduce its dependence on imported rice by making wheat flour available to consumers at a price on par with that of rice.[6]

The Government's pricing policies have generally involved a substantial subsidy. The extent to which the subsidy reaches final consumers of wheat products, however, is difficult to analyze because the subsidy occurs implicitly when wheat is released to the mills by BULOG at below world prices. Wheat then moves through several processing and marketing channels

[6]For arguments against increasing the dependency on wheat, see Nyberg (8).

**Figure 3: Monthly rice and wheat flour prices in Jakarta**




U.S. $1.00 = 378 rupiah, January 1971 - July 1971
= 415 rupiah, August 1971- October 1978
= 625 rupiah, November 1978 - October 1980

Source: BULOG

before it reaches consumers as flour or baked goods. Margins for the distribution chain, which includes distributors, wholesalers, and retailers, have declined as a percentage of the price paid for flour since 1973 and have remained fairly steady over the last 5 years (table 5). Current margins are also well below those of the late sixties when flour was just being introduced in large quantities and margins of over 100 percent were thought necessary to handle the flour (*12*). The Government can effectively put downward pressure on margins by increasing market allocations and thereby driving retail prices toward the

**Table 5 — Average wheat distributor and mill marketing margins, Indonesia**

| Period[1] | Distribution chain margins | Distribution chain margins as percentage of buying price from mills | Mill margins | Mill margins as percentage of input cost of wheat |
|---|---|---|---|---|
| | *Rupiah per kilogram* | *Percent* | *Rupiah per kilogram* | *Percent* |
| June 1973-April 1974 | 18.6 | 30.1 | 17.8 | 44.2 |
| April 1974-April 1975 | 21.0 | 33.8 | 15.5 | 36.5 |
| April 1975-March 1976 | 20.7 | 24.2 | 12.7 | 18.6 |
| March 1976-March 1979 | 23.9 | 22.7 | 16.8 | 19.9 |
| March 1979-May 1980 | 36.8 | 25.1 | 27.6 | 24.3 |
| May 1980-February 1981 | 41.8 | 24.8 | 27.6 | 24.3 |

[1]Periods correspond to those in which specific mill fee structures were in effect.

Source: Estimated from official sources.

Government-set price at which distributors obtain flour. Present retail margins may have been driven to a minimum through such Government injections.

Mill margins in table 5 are calculated as the difference between the price received by the mills for a kilogram of flour and the cost of wheat used to produce that flour. These margins, as a percentage of the input cost of wheat, have declined since the early seventies when the mills began operations, but jumped to over 24 percent in 1979 and 1980. The increase was due mainly to a change in accounting procedures as BULOG changed the flour milling rate used in determining the mill fee structure from 72 to 74 percent. This caused an apparent decline in the input cost of wheat; without the change, margins would have been about 21 percent.[7] Mill margins in 1980 were maintained at 1979 levels, but the price charged distributors for flour was raised through a subsidy fee amounting to 22 rupiah per kilogram. The fee is returned by BULOG to the Department of Finance and offsets the subsidy on imported wheat.

The mill fee structure allows mills to recover some profits as well as their processing and handling costs. Since the fee structure pertains only to flour, additional profits can be made from the sale of wheat byproducts, about which little is known. In comparison to that in Indonesia, the margin between wholesale flour prices and the input cost of wheat in the United States has generally been much smaller, averaging 4.5 percent from 1977 to 1979. The total U.S. processing margin, which includes the sale of wheat byproducts, averaged 22 percent over those years.[8] A similar figure for Indonesia is difficult to obtain because of the lack of price or sales data for bran and other wheat byproducts. A rough estimate of the Indonesian processing margin in 1979, however, would be 35 percent if one assumes a 26-percent bran extraction rate and that the mills

[7]If the mills were in fact using a 74-percent extraction rate prior to 1979, their effective margins would have been higher than those presented in table 5.

[8]Margins are based on average cash wholesale prices for wheat and baking flour in the Kansas City and Minneapolis markets during the 1977/78 to 1979/80 marketing years (14).

receive 80 percent of the average f.o.b. unit value of total cereal byproduct exports.[9] Judging the profitability of the Indonesian milling industry by comparing margins with those in the United States is in any case highly speculative. Not only are comparable data difficult to obtain (including data on labor and capital costs), but the U.S. milling industry is more vertically integrated than that of Indonesia. Major U.S. mills manufacture processed flour products, such as crackers and cookies, and other convenience foods, such as prepared flour mixes. These products now account for a large share of total sales volume and are an important determinant of the U.S. industry's overall profitability (7).

Whether or not the subsidy involves a cost to the Indonesian Government depends on the terms under which wheat is imported. The difference between BULOG's surrender price and the landed cost of wheat received on a grant or concessional basis is available to the Government. Wheat purchased on commercial terms generally involves a cash subsidy which is absorbed by the Department of Finance.

The Government has occasionally made upward adjustments to the BULOG surrender price for grain in order to reduce the wheat subsidy (table 6). Mill margins are usually maintained by a simultaneous upward adjustment in their selling prices. During the 3 years prior to the November 1978 devaluation of the rupiah, for example, only minor changes were made in the Government's policy prices. The subsidy on wheat, meanwhile, declined of its own accord because of declining world prices. Following the devaluation, the wheat subsidy would have climbed to approximately $70 per ton at a total annual cost of $70 million to the Government. The Government maintained the subsidy for several months in an effort to contain food prices. But finally, in March 1979, the Government raised BULOG's surrender price for grain from 60.9 rupiah per kilogram ($97.46 per ton) to 84.2 rupiah per kilogram ($134.70 per

[9]Indonesia exported 585,000 tons of bran and other cereal residues at a total f.o.b. value of $42.5 million in 1979. The implied unit value for these exports is $72.65 per ton or 45.4 rupiah per kilogram.

ton) and the mill selling price for flour from 105.7 rupiah per kilogram ($169.12 per ton) to 146.5 rupiah per kilogram ($234.37 per ton). The wheat subsidy was thereby reduced to about $34 per ton.

Changes in the mill selling price appear to have a fairly immediate impact on retail flour prices (fig. 3). If the current retail price of flour does not provide an adequate margin for distributors after Government price changes have been implemented, flour is likely withheld from the market until retail prices increase. Thus, the mill selling price plus margins effectively provide a floor for flour prices and the latter exhibit little downward flexibility, especially in comparison to rice prices.

**Table 6 — Indonesian wheat subsidy for commercial imports**

| Year | Average c.i.f. cost of imported wheat | BULOG surrender price to mills | Implied subsidy |
|---|---|---|---|
| | *U.S. dollars per metric ton*[1] | | |
| 1973/74 | 147.18 | 69.45 | 77.73 |
| 1974/75 | 238.32 | 73.38 | 164.94 |
| 1975/76 | 203.81 | 118.06 | 85.75 |
| 1976/77 | 160.94 | 146.07 | 14.87 |
| 1977/78 | 102.56 | 146.07 | 0 |
| 1978/79: | | | |
| Post-devaluation | 168.89 | 97.46 | 71.43 |
| Post mill price increase | 168.89 | 134.70 | 34.19 |

[1]A predevaluation exchange rate of 417 rupiah per U.S. dollar and a post-devaluation rate of 625 rupiah per U.S. dollar were used to convert BULOG's grain selling price into dollars. It is not known whether the import price data, which are for commercial imports, refer to landed or contractual prices. The implied subsidy should therefore be viewed only as a rough estimate.

Source: Estimated from official sources.

A more detailed examination of shortrun price determination requires monthly information on the stock behavior of mills and distributors. Rumors of a Government price increase can lead to a rundown of stocks at the mills as distributors hoard flour in anticipation of the price increase. Such activity can lead initially to an increase in retail prices prior to the implementation of ex-factory price changes and some softening of prices as speculative stocks are depleted (fig. 3). This situation can also arise prior to peak periods of demand during holiday seasons. The Government has, on at least one occasion, taxed the windfall profits accruing to the mills as a result of changes in the mill fee structure and thus the value of their stocks. To counter the speculative behavior of distributors, market allocations can be increased prior to the Government price change. In 1980, a year of significant speculative activity in the Jakarta market, this was done by transferring flour from the Prima and Bogasari Surabaya marketing districts to the Jakarta area and by reducing allocations to distributors in areas outside Jakarta. BULOG also, for the first time in several years, imported wheat flour under P.L. 480, Title I, for direct injection into the market.

## Wheat Consumption

Per capita wheat consumption in Indonesia has almost doubled over the past decade. But, the contribution of wheat to total per capita caloric intake is still only 1.5 percent, and remains well below that of the three main staples: rice, corn, and cassava (table 7). This understates the importance of wheat to the economy, however. Not only has per capita consumption risen sharply over the past decade, but wheat is very important in meeting Indonesia's imported cereal needs. On a daily basis in 1977, for example, 199 calories per capita came from imported rice and wheat. Wheat accounted for 27 percent of this total.

The 1976 Indonesian Household Consumption Survey (SUSENAS) reported per capita consumption of wheat flour as 1.1 kilograms per year or about 20 percent of that implied by the

**Table 7 — Annual per capita wheat consumption and daily per capita calorie intake of major food staples, Indonesia[1]**

| Commodity | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Kilograms* | | | | | |
| Wheat | 3.30 | 2.59 | 3.45 | 3.50 | 2.51 | 3.63 | 4.90 | 3.95 | 5.05 | 5.63 |
| | | | | | *Calories* | | | | | |
| Wheat | 32 | 25 | 33 | 33 | 24 | 35 | 47 | 38 | 48 | 54 |
| Rice | 952 | 1,165 | 1,070 | 1,065 | 1,068 | 1,164 | 1,140 | 1,127 | 1,165 | 1,212 |
| Maize | 258 | 172 | 203 | 182 | 165 | 258 | 202 | 201 | 175 | 206 |
| Sweet potatoes | 50 | 48 | 45 | 44 | 41 | 46 | 46 | 45 | 42 | 42 |
| Cassava | 193 | 169 | 153 | 143 | 144 | 169 | 176 | 181 | 204 | 203 |
| Soybeans | 30 | 28 | 35 | 36 | 35 | 33 | 37 | 37 | 52 | 44 |
| Groundnuts | 28 | 25 | 26 | 26 | 27 | 25 | 27 | 34 | 31 | 36 |
| Total | 1,543 | 1,632 | 1,565 | 1,529 | 1,504 | 1,730 | 1,675 | 1,663 | 1,717 | 1,797 |
| Total all foods | 2,035 | 2,141 | 2,097 | 2,070 | 2,052 | 2,247 | 2,248 | 2,150 | 2,231 | 2,330 |

[1]1977 figures have been revised to reflect higher wheat imports than those published by BPS. None of the data reflect the revised BPS population estimates. These population estimates are lower than those used in calculating per capita calorie intake above.

Source: *Neraca Bahan Makanan di Indonesia* (Indonesian Food Balance Sheets), 1968-77, Biro Pusat Statistik, various issues.

Food Balance Sheet data in table 7.[10] It appears, therefore, that most wheat flour is actually consumed in some processed form: bread, biscuits, noodles, and cakes. Of these products, only rupiah expenditures on bread and biscuits are covered directly by SUSENAS. Consumption of noodles, which is very significant, is not covered and the consumption of wheat products in restaurants or outside the home is included in a prepared foods category for which no commodity breakdown is given.

Data from SUSENAS are useful in determining the distribution of wheat flour consumption by region and income class and for comparing flour consumption with that of other food staples (tables 8 and 9). Flour is consumed primarily by high-income groups in urban areas. In comparison, rice is the predominant food staple for all segments of the population. Dried corn and cassava are relatively more important staples for low-income groups, especially in rural areas. This has important implications for policy, since it implies that high-income groups benefit directly from the wheat subsidy.

Although Java has greater milling capacity, per capita flour consumption is higher on the Other Islands. This is confirmed by alternative data from BULOG on the 1980 flow of flour to the Indonesian provinces. These data are more comprehensive than those from SUSENAS since flour, which will be processed into other products, is also included. According to BULOG, the Jakarta city district had the highest per capita consumption in Indonesia (32.4 kilograms per year), while the rest of Java with its large rural population had the lowest (3.2 kilograms per

[10]Little was known about the quantity of flour flowing into the various processing industries or about the final consumption of wheat-based products in Indonesia until the 1980 Pan Asia survey (9). Information on total flour consumption and its importance in the Indonesian diet could be obtained from supply-utilization data contained in the Indonesian Food Balance Sheets (see table 7). A very limited amount of information on the consumption of wheat-based products is contained in SUSENAS. The Pan Asia survey provides additional insights on the relative importance of the various wheat products consumed in Indonesia and their distribution by income class. All three sources of information are discussed in this section.

**Table 8 — Annual per capita wheat product consumption and expenditures, Indonesia, 1976**

| Region | Urban | Rural | Urban and rural |
|---|---|---|---|
| | | *Kilograms* | |
| Wheat flour consumption: | | | |
| Java | 1.1 | 0.3 | 0.5 |
| Other Islands | 3.2 | 2.0 | 2.2 |
| Indonesia | 1.9 | .9 | 1.1 |
| | | *Rupiah* | |
| Bread and biscuit expenditures: | | | |
| Java | 1,191 | 245 | 417 |
| Other Islands | 909 | 430 | 516 |
| Indonesia | 1,088 | 313 | 453 |

Sources:
- Wheat flour consumption — *Indonesia Survey Sosial Ekonomi Nasional Tahap Ke-Lima (Januari-Desember 1976)*, Biro Pusat Statistik, 1979.
- Bread and biscuit expenditures — Biro Pusat Statistik, Jakarta, unpublished.

**Table 9 — Annual per capita consumption of various foods, by monthly expenditure class, Indonesia, 1976**

| Expenditure class | Sample proportion | Wheat flour | Rice | Dried cassava | Corn |
|---|---|---|---|---|---|
| *Rupiah* | *Percent* | | *Kilograms* | | |
| Less than 3,000 | 39 | 0.2 | 80.2 | 10.6 | 13.8 |
| 3,000-4,999 | 33 | .6 | 119.8 | 4.9 | 9.1 |
| 5,000 and over | 28 | 3.0 | 144.2 | 2.6 | 5.2 |

Source: (8) p. 11. Based on 1976 SUSENAS data.

year).[11] Average per capita consumption on the Other Islands was 7.2 kilograms per year and was the highest in South Kalimantan, North Sulawesi, Maluku, and Riau. With the exception of South Kalimantan, which has a large fishing industry and produces fried fish-flour foods, these provinces have been influenced by Dutch eating habits or are relatively affluent because of petroleum.

Data from the Pan Asia Survey agree with the SUSENAS estimate that about 20 percent of all flour is consumed directly by households in unprocessed form (table 10).[12] Wheat products were found to be a regular part of the diet for many urban households, as some 67 percent of those surveyed purchased foods made from wheat at least monthly. In addition, approximately 20 percent of those surveyed consumed some form of wheat product as their principal food for breakfast. The most commonly purchased foods were bread and noodles, which accounted for about 58 percent of all wheat utilized in Indonesia.[13] Per capita consumption was highest for those households having expenditure levels over 15,000 rupiah per month. These households also exhibited a clear preference for processed flour products over flour.

Despite the regularity of wheat product purchases by many Indonesian households, such products are still luxury foods beyond the reach of most Indonesian consumers. These products have not become important staples for large segments of the population and are consumed only occasionally or as supplements to the main diet. Purchases of wheat products are most often made after the fasting month preceding the Moslem

[11]Per capita consumption in Jakarta may be biased upward because it is a major terminal for the shipment of flour and flour products throughout Indonesia.

[12]The Pan Asia survey estimate of per capita consumption of unprocessed flour in urban areas, however, is much higher than that from SUSENAS. If Pan Asia results are extended to the national level and if consumption in rural areas is treated as a residual, a much higher urban-to-rural consumption ratio than in SUSENAS is found. This probably reflects a discrepancy between the two surveys, since such a shift in consumption patterns between the surveys is unlikely.

[13]Table 10 is based on the survey of urban households whereas figure 1 is based on the survey of flour utilization by the Indonesian processing industry. The estimate of 58 percent is taken from the latter survey.

**Table 10 — Per capita consumption of flour, by type of product, Indonesian urban areas, 1980**

| Expenditure class | Wheat flour | Bread | Cookies | Noodles | Other | Total |
|---|---|---|---|---|---|---|
| *Rp/month* | | | *Kilograms* | | | |
| Over 15,000 | 3.7 | 18.0 | 2.2 | 5.9 | 1.8 | 31.6 |
| 6,000-15,000 | 6.6 | 7.4 | 1.1 | 4.1 | .8 | 20.0 |
| Below 6,000 | 2.4 | 5.9 | .5 | 3.3 | .3 | 12.4 |
| Average | 4.1 | 9.5 | 1.1 | 4.2 | .9 | 19.8 |

Source: (9).

holy day Lebaran, or on holidays and other special occasions. Popular foods on these occasions are the wide variety of cookies and cakes produced in Indonesia. These products, as well as other snacks, are also produced in the home.

## Cross-Sectional Expenditure Elasticity of Demand

Previous studies using cross-sectional data have indicated a fairly high expenditure elasticity of demand for wheat products in Indonesia. Timmer, for example, reported an elasticity of 1.8 based on 1968 Jakarta household consumption data for wheat flour and bread products (12). We now estimate the expenditure elasticity of demand for flour using 1976 SUSENAS data and examine in more detail the nature of this elasticity. The data are grouped into 10 expenditure classes and are reported on a per capita basis in appendix table 3.[14]

A log-log inverse functional form is assumed to represent the consumption function for wheat flour. This particular form allows rapidly increasing rates of consumption at low-income

[14]Grouping of the SUSENAS data results in considerable loss of information, few degrees of freedom, and misleadingly high $R^2$'s and low t-values. The elasticities in this section were estimated in order to provide a basis of comparison with the preferred time-series estimates of the following section and with elasticities for other food items based on aggregate SUSENAS data.

levels and a saturation point, after which consumption declines with income, at high-income levels. It is thus likely to give a fairly good representation of food demand over a wide range of incomes. The demand equation for flour can thus be written:

$$\ln(C) = a + b \cdot \ln(Y) + c \cdot (1/Y) + \ln(u) \qquad (1)$$

or equivalently,

$$C = e^{a} \cdot Y^{b} \cdot e^{c/Y} \cdot u \qquad (1')$$

where: C = per capita flour consumption,
Y = per capita expenditure,
u = disturbance term, and
a,b,c are the parameters to be estimated.

Statistical results from estimating equation 1 are reported in table 11. Since the coefficient on the inverse of expenditure is small and statistically insignificant, the consumption function could as well have been written in log-log form with a constant expenditure elasticity of demand equal to 1.7. This elasticity is nearly identical to that reported by Timmer. An examination of the predicted values of flour consumption, however, indicates an extremely large error in the prediction of flour consumption by the highest SUSENAS income group and that the equation does not pick up the leveling off in consumption evident for high-income groups. These groups consume most of the wheat flour in Indonesia and are also the groups most likely to have low and declining income elasticities of demand.

In estimating equation 1, we assumed that the disturbance term, u, is multiplicative and log-normally distributed. Least squares minimization was thus performed on the logarithm of the disturbance term. In an attempt to better capture the leveling off in consumption by high-income groups, we now make an alternative assumption about the error structure and reestimate the equation in the following form using nonlinear regression methods (3):

$$C = e^{a} \cdot Y^{b} \cdot e^{c/Y} + u \qquad (2)$$

**Table 11 — Cross-sectional analysis of the expenditure elasticity of demand[1]**

| Equation | Assumptions on disturbance term | Parameters a | b | c | d | $\bar{R}^2$ | Durbin-Watson statistic | Number of observations |
|---|---|---|---|---|---|---|---|---|
| 1 | Log normal multiplicative | -18.57 (-6.7) | 1.71 (5.8) | 45.6 (.1) | | 0.95 | 1.0 | 10 |
| 2 | Normal additive | 3.93 (3.9) | .52 (-5.4) | -16,057 (-14.4) | | .99 | 1.6 | 10 |
| 3 | Normal additive | 1.80 (.9) | -.29 (-1.5) | -14,545 (-6.5) | -0.036 (-8.6) | .99 | 1.7 | 20 |
| 4 | Log normal multiplicative | -13.8 (-23.8) | 1.86 (27.2) | | | .99 | 1.2 | 10 |
| 5 | Log normal multiplicative | -10.2 (-11.3) | 1.36 (12.7) | | | .95 | .8 | 10 |

[1]The t-values are in parentheses. Equations 2 and 3 are estimated after taking consecutive Taylor expansions of the demand curve about the previous iteration's ordinary least squares estimate of the parameter values. Equation statistics are based on the final iteration of this process. See (3).

In this equation, an additive, normally distributed disturbance is assumed and least squares minimization is performed on the actual error structure.

Results from estimating equation 2 indicate that all parameters are statistically significant and that the expenditure elasticity of demand declines throughout the income range reported in SUSENAS.[15] The equation thus predicts a leveling off in consumption at high-income levels. In order to further compare results with those from equation 1, we calculate adjusted multiple correlation coefficients for both equations using C as the dependent variable.[16] Results indicate that equation 2, ($R^2$ = 0.99), gives a much better fit to the data than equation 1, ($R^2$ = 0.59).

Equation 2 parameter estimates can be used to calculate several additional parameters useful in describing wheat consumption in Indonesia.[17] For example, flour is a luxury good (expenditure elasticity greater than 1) for those consumers having income levels below 10,563 rupiah per month ($305 per year in 1976). Kelch, in a study using cross-sectional data from low-, middle-, and high-income countries, found that wheat as a food grain is a luxury food at a similar income level of $329 per year (5). Flour consumption peaks (or reaches a saturation level with an expenditure elasticity of demand equal to zero) at 7.3 kilograms per year, a level only slightly above the highest average consumption recorded for any income group in the Pan Asia survey. In contrast to SUSENAS, however, the Pan Asia survey shows a decline in flour consumption by the highest SUSENAS income group. Finally, expenditure elasticities implied by equation 2 for the top four income groups in Indonesia, or those

[15]The expenditure elasticity for the log-log inverse functional form is equal to (bY-c)/Y.

[16]Since the dependent variables in equation 1, ln(C), and equation 2, C, are different, the adjusted multiple correlation coefficients reported in table 11 are not comparable.

[17]Although equation 2 gives an excellent fit to the data, one must remain skeptical of the parameter estimates since there are so few observations on those income groups consuming most of the flour. In addition, the expenditure elasticity is for flour only, not processed flour products.

groups consuming most of the wheat, decline rapidly with increased income and are as follows: 1.89 (6,000-8,000 rupiah per month), 1.23 (8,000-10,000 rupiah per month), 0.83 (10,000-15,000 rupiah per month), and 0.22 (over 15,000 rupiah per month).

The fact that per capita consumption of wheat flour is higher in urban than in rural areas may be due to differences in tastes. We, therefore, disaggregate the SUSENAS data according to urban-rural areas and reestimate equation 2 in the following form:

$$C = e^{a+d \cdot D} \cdot Y^{b} \cdot e^{-c\,Y} + u \qquad (3)$$

where D is a dummy variable which takes the value 1 for observations from urban groups and is zero otherwise. The estimate of d in equation 3 is significant but also negative (table 11). Urban groups thus appear to have less of a preference for flour than rural groups (and perhaps a greater preference for processed flour products). If so, the higher wheat flour consumption observed in urban areas must be explained by higher income levels. According to the 1976 SUSENAS survey, for example, 54 percent of the urban population had expenditure levels above 5,000 rupiah per month, whereas only 22 percent of the rural population had expenditures above this level.

We report equations 4 and 5 for information only. Equation 4 employs a log-log form with log-normally distributed errors to represent per capita expenditure on bread and biscuits. Since the dependent variable is in value terms and likely to increase with income as consumers pay higher prices for higher quality products, the estimated elasticity of 1.9 is biased upwards. We have attempted to remove this bias in equation 5 by deflating bread and biscuit expenditures by a cost of calorie index developed by Tabor (11). While the elasticity estimate drops to 1.4, we have no way of knowing whether or not the index, which is based on an average for a large number of commodities, in any way reflects quality changes in the bread and biscuit category.

## Time-Series Income and Price Elasticities of Demand

In 1971, Timmer published own- and cross-price elasticities of demand for wheat flour (*12*). This section updates and expands on Timmer's work. The major differences between his and our analyses are:

1. We expand the observation period used by Timmer from 1952-69 to 1951-79.

2. We include per capita Gross National Product (GNP) as a proxy for per capita incomes in our regressions. Timmer observed very little variation in income over his estimation period and therefore excluded it from his regressions. In recent years, however, incomes in Indonesia have risen quite sharply.

3. We attempt to estimate cross-price elasticities for several food items in addition to rice.

4. Since the cross-price elasticities for wheat flour with respect to food and nonfood items are likely to be quite different and since a general food index would include food items which we have attempted to incorporate directly into our analysis, we deflate our price and income variables by a Jakarta nonfood price index. Timmer deflated by a Jakarta cost-of-food index with rice excluded.

Data used in the analysis are contained in appendix table 4. In addition to the use of different price series to deflate price and income variables, there are several other minor differences between Timmer's and our data, especially during the latter years of Timmer's observation period. Foremost of these are our exclusion of data on wheat flour inventories held by flour syndicates and our use of the BULOG price series for medium quality rice from 1967 on. Stock information for the flour syndicates was available for 1968 and 1969 only and, in order to achieve

consistency, we instead use stock data obtained from the Indonesian Food Balance Sheets and the U.S. Agricultural Attache. Unfortunately, these data extend back to 1970 only. Whereas Timmer used the Jakarta price of cheap quality rice, it is probable that medium quality rice is more of a substitute for wheat flour and we therefore use the BULOG series for those years in which it is available.

In addition to flour and rice prices, Timmer included in his regressions a dummy variable, DD. This variable takes on the value 1 during years of political unrest, namely 1958 and 1961-65, and is zero otherwise. Since wheat flour consumption was found to be significantly lower than is explainable by incomes and prices alone during these years, we include DD in all our regressions.

Although Timmer reported estimation results for several equations, the one quoted most often in the literature is equation 1 in table 12. He found the own-price elasticity of demand for wheat flour to be -1.4 and the cross-price elasticity of demand with respect to rice to be 1.2. The results from reestimating Timmer's equation over a period identical to his but using slightly different data and the results from reestimating the equation over the expanded data set are presented in equations 2 and 3, respectively. Equation 2 is nearly identical to that obtained by Timmer in spite of minor modifications to his data. Equation 3 is interesting because the low Durbin-Watson statistic indicates a possible specification bias. We shall see later that the inclusion of income in this equation improves its statistical properties considerably.

We, like Timmer, assume that consumption of wheat flour is represented by a constant elasticity functional form. The demand equation can thus be written:

$$C = A \cdot (P_w/P_n)^{b_w} \cdot (P_r/P_n)^{b_r} \cdot (P_o/P_n)^{b_o} \cdot (Y/P_n)^{b_Y}$$

## Table 12 — Time-series analysis of income and price elasticities of demand[1]

| Equation | Dependent variable | Constant | $\ln(P_w/P_n)$ | $\ln(C)$ | $\ln(P_r/P_n)$ | $\ln(P_m/P_n)$ | $\ln(Y/P_n)$ | Trend | DD | $\bar{R}^2$ | Durbin-Watson statistic | Number of observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1[2] | ln(C) | 1.68 | -1.41 | | 1.22 | | | | -0.87 | 0.91 | 2.11 | 18 |
| | | (1.32) | (-8.36) | | (3.71) | | | | (-5.31) | | | |
| 2 | ln(C) | -6.86 | -1.46 | | 1.14 | | | | -.85 | .88 | 1.97 | 18 |
| | | (11.21) | (-7.84) | | (3.98) | | | | (-5.15) | | | |
| 3 | ln(C) | -8.25 | -1.82 | | .75 | | | | -.72 | .84 | 1.11 | 29 |
| | | (-13.11) | (-7.77) | | (2.13) | | | | (-3.37) | | | |
| 4 | ln(C) | 2.04 | -1.39 | | .57 | | 1.00 | | -.79 | .94 | 2.16 | 29 |
| | | (1.31) | (-9.05) | | (2.72) | | (6.82) | | (-6.19) | | | |
| 5 | $\ln(P_w/P_n)$ | .21 | | -0.56 | .51 | | .46 | | -.42 | .91 | 1.90 | 29 |
| | | (.21) | | (-9.05) | (4.60) | | (3.66) | | (-4.30) | | | |
| | [-1.80] | | | | [.92] | | [.84] | | | | | |
| 6 | $\ln(P_w/P_n)$ | -.87 | | -.63 | | 0.46 | .38 | | -.39 | .88 | 1.78 | 29 |
| | | (-.76) | | (-9.49) | | (3.19) | (2.47) | | (-3.48) | | | |
| | [-1.58] | | | | | [.72] | [.60] | | | | | |
| 7 | $\ln(P_w/P_n)$ | .11 | | -.56 | .47 | .07 | .45 | | -.43 | .91 | 1.88 | 29 |
| | | (.10) | | (-8.69) | (2.75) | (.37) | (3.23) | | (-4.23) | | | |
| | [-1.78] | | | | [.83] | [.12] | [.79] | | | | | |
| 8 | $\ln(P_w/P_n)$ | .02 | | -.56 | .47 | .07 | .44 | 0.01 | -.43 | .90 | 1.88 | 29 |
| | | (.01) | | (-8.43) | (2.42) | (.37) | (2.12) | (.08) | (-3.89) | | | |

[1]The t-values are listed in parentheses in the second row of each equation. Where applicable, implied elasticities for relevant variables are contained in brackets in the third row.

[2]Equation 1 is that estimated by Timmer. Equation 2 is identical to equation 1 but is estimated using slightly different data. All other equations are estimated over the expanded data set.

where $C$ = per capita consumption of wheat flour,
$A$ = a constant,
$P_w$ = the Jakarta retail price of wheat flour,
$P_r$ = the Jakarta retail price of rice,
$P_o$ = the retail price for one other food item yet to be specified,
$P_n$ = Jakarta nonfood price index, and
$Y$ = per capita GNP.

Other commodities which may eventually be incorporated into the analysis are maize (symbolized by m), cassava (symbolized by c) and soybeans (symbolized by s). The $b_i$'s are the income and price elasticities of demand. We also know that under the assumption that this equation is homogeneous of degree zero, the cross-price elasticity of demand for wheat flour with respect to nonfood commodities, $b_n$, must be equal to $-(b_w + b_r + b_o + b_Y)$.

We prefer to estimate the demand equation in inverted form with the relative price of wheat flour as the dependent variable. Data on wheat flour consumption are derived as residuals from supply-utilization balance sheets. Data on stock changes contained in these sheets are unavailable for most years and are probably unreliable in others. Flour consumption is thus equal to imports over most of our estimation period. Timmer preferred to treat flour imports as the exogenous variable during the years 1952-69 (*12*, 85).[18] This also should clearly be the case for 1969-73 when most imports were concessional. The real problem arises over the last few years when imports, and stock changes, depend in part on price changes and *vice-versa*. Although the Government can influence retail flour prices, there is no exogenously set policy price on the retail market.

[18]When estimating the demand function in this form, Timmer found an own-price elasticity of -1.7 and a cross-price elasticity with respect to rice of 1.12 (*12*).

Imports, on the other hand, are policy determined and we thus prefer to treat them as being exogenous.[19]

Inverting the demand equation above, taking logarithms so that the equation is linear in the independent variables and including the dummy variable DD, we have the following equation for estimation:

$$\ln(P_w/P_n) = b_1 - b_2 \cdot DD + 1/b_w \cdot \ln(C) - b_r/b_w \cdot \ln(P_r/P_n) - b_o/b_w \cdot \ln(P_o/P_n) - b_Y/b_w \cdot \ln(Y/P_n) + u.$$

Although we prefer a demand equation written in this form, we have estimated both forms for comparison. Results are reported in equations 4 and 5 of table 12. Neither equation includes, for the time being, prices of any food substitutes other than rice.

According to equation 4 in which wheat consumption is the dependent variable, the own-price elasticity of demand is -1.39, the cross-price elasticity with respect to rice is 0.57, and the income elasticity of demand is 1.0.[20] The estimated cross-price elasticity is about half that obtained by Timmer and may indicate a bias in his results because of an omitted variable. The income elasticity is identical to that quoted by Nyberg (*8*) and is within the range implied by the cross-sectional analysis in the previous section of this report. All variables are significant at the 5-percent significance level.

In equation 5, elasticities comparable to those in equation 4 are obtained by dividing through the relevant regression coefficients by the coefficient on wheat flour consumption. These

[19]Lack of data on stock changes also gives rise to errors in the measurement of consumption. Since stock changes likely depend on other variables in the demand equation, ordinary least squares estimates of our parameters will be biased and inconsistent whether consumption is placed on the left- or right-hand side of the demand equation. We assume this problem is minor.

[20]We attempted to introduce personal consumption expenditure as a proxy for permanent incomes in our equations. The implied elasticities were approximately the same for either income variable, but GNP had more explanatory power. Personal consumption expenditure is defined as a residual on the Indonesian GNP accounts and may be subject to more errors in measurement.

elasticities are indicated in brackets in the third row of parameters for this equation. As in equation 4, all variables are significant at the 5-percent significance level. The implied elasticities, however, have all changed with a somewhat lower income elasticity of 0.84 and higher own- and cross-price elasticities of -1.80 and 0.92, respectively. We prefer, in any case, the elasticities implied by equation 5 on grounds of causality.

The previous analysis did not treat any substitutes for wheat flour other than rice. Possible substitutes include products processed from maize, cassava, sweet potatoes, and higher protein foods such as soybeans. These commodities are probably not close substitutes for wheat flour since they are consumed primarily by different income groups.[21] But, neither are they complements and we expect that a positive change in the price of one of them will lead to higher consumption of wheat flour. Expenditures on these commodities make up a relatively small proportion of the consumer budget and the income effects induced by changes in their respective prices will be close to zero.[22] This, along with an estimated income elasticity of demand for wheat flour which is near unity, implies that the impact of a price change will approximately equal the pure substitution effect which is positive if these commodities are indeed flour substitutes.

The addition of price terms for the various substitutes generally gave poor results. When the prices of all commodities were introduced, only the coefficient on the price term for maize had a positive sign and was significantly different from zero.[23] The equation exhibited negative serial correlation and the coefficient on soybean prices was both negative and significant. In separate regressions which excluded the price of rice and

[21]There are also a limited number of substitution possibilities for industrial use. For example, a small amount of wheat flour is used as a substitute for cassava starch in the making of glue for the plywood industry.

[22]The budget share for cassava and cassava products, for example, was 2.6 percent, according to the 1976 SUSENAS survey.

[23]Sweet potato prices were excluded since their correlation with cassava prices is 0.98.

included the price of only one substitute (see equation 6 as an example), the signs of the coefficients on each substitute price term were positive but only the coefficient on maize prices was both positive and significantly different from zero.

The matrix of simple correlations for the transformed price variables used in these regressions is:

| | *Rice* | *Maize* | *Cassava* | *Soybeans* |
|---|---|---|---|---|
| Rice | 1 | 0.70 | 0.43 | 0.17 |
| Maize | | 1 | .73 | .63 |
| Cassava | | | 1 | .60 |
| Soybeans | | | | 1 |

Since the prices are highly correlated, we conclude that it is impossible to estimate separate cross-price elasticities or determine the degree of substitutibility between wheat and nonrice foods given currently available time-series data.[24]

We introduce maize and rice alone as possible substitutes for wheat flour in equation 7. Although the coefficient on the price of maize is small and insignificant, it is positive and we elect to include it in the regression. We expect that maize will be less of a substitute for wheat flour than is rice. Furthermore, to the extent that changes in maize prices do have an impact on flour consumption, excluding them from the regression leads to an upward bias in the estimate for the cross-price elasticity of demand for wheat flour with respect to rice. Elasticities of demand for wheat flour implied by equation 7 are:

| | |
|---|---|
| Own-price elasticity | -1.78 |
| Cross-price elasticity with respect to rice | .83 |
| Cross-price elasticity with respect to corn | .12 |
| Cross-price elasticity with respect to nonfoods | .04 |
| Income elasticity | .79 |

[24]Simple correlations do not in themselves indicate the severity of the multicollinearity. The Farrar and Glauber Chi-Square test was conducted on the above correlation matrix and the multicollinearity found likely to be severe. See (4).

In the final regression, equation 8, we introduce a time trend in an effort to capture changes in tastes. This variable is insignificant, causes little change in our estimated coefficients, and leads to a small reduction in corrected $R^2$. We take this as evidence that there has been no significant change in tastes either toward or away from wheat flour during our observation period.

## Wheat Import Projections to 1985

We are now in a position to use the econometric results from equation 7 of table 12 to project Indonesian wheat imports to 1985. These projections indicate a 1.9-million ton wheat import demand by 1985, more than half of which could be supplied by the United States. The projections are based on the assumption that the Indonesian Government follows a neutral policy regarding wheat and rice imports. Relative prices of both commodities are held constant and quantities imported are just enough to meet the growing demand resulting primarily from population and income growth.[25] We relax these assumptions in the following section to examine the additional imports required should the Government actively encourage wheat imports through relative price changes.

Exogenous assumptions on income and population growth are based on trends in these variables since the late sixties. By then, the Indonesian economy had stabilized from the political upheavals earlier in the decade and technological developments had begun to have an impact on food production. Under a neutral food policy, maize prices are also allowed to change according to previous trends. The Government has recently im-

[25]The policy is called neutral for want of a better word. Little wheat or wheat flour was imported prior to 1968, prospects for producing wheat on any substantial scale are slim to nonexistent, and flour consumption has been subsidized in most years. Those most concerned with Indonesia's increasing dependence on an imported food grain might not consider any price policy which leads to increased imports, as is the case here, and continuation of the wheat subsidy as being neutral.

plemented farm support prices for maize; but, these have been ineffective and for all practical purposes maize prices are not policy controlled. Our assumptions on the annual growth rate of each independent variable to 1985 and a brief discussion of the reasoning underlying these assumptions are as follows:

- Population (2 percent). Based on revisions in Indonesian population estimates resulting from the 1976 intercensus survey (1).

- Per capita GNP deflated by nonfood prices ($Y/P_n$) (6 percent). The general consensus is that growth in real GNP, which was 7.4 percent per year between 1968 and 1978, will slow to under 6 percent. Between 1968 and 1978, nominal GNP deflated by the nonfood price index grew at 9.6 percent annually.[26] The discrepancy between the two growth rates arises because nonfood prices rose at a slower rate than food prices and the GNP deflator. Assuming that the growth rate of the overall economy slows by 1.6 percent per year, continuing lower nonfood price inflation, and discounting for 2-percent growth in population, the annual growth in $Y/P_n$ will be about 6 percent.

- Maize prices deflated by nonfood prices ($P_m/P_n$) (3.4 percent). The higher rate of food price inflation relative to nonfood price inflation was in part due to rapid increases in secondary food crop prices. Retail prices for cassava, corn, and soybeans all rose substantially between 1969 and 1979. The increase in relative corn prices amounted to 3.4 percent per year.

- Inventories. It is assumed that wheat inventories are held for transaction purposes only. Desired inventories amount to 18 percent of flour consumption and actual inventory levels are adjusted immediately during any given year to desired levels.

[26]The various growth rates for GNP are calculated from 3-year averages centered on 1968 and 1978.

Under neutral policy assumptions, we project Indonesian wheat imports to increase at an annual rate of 7.9 percent between 1979 and 1985 and to reach 1.9 million tons in the latter year (table 13). This would put a severe strain on current milling capacity, but is well within the capacity now being considered for 1982/1983. The projected annual rate of increase is lower than the 9.7-percent rate which occurred between 1973 and 1979, the period during which Indonesia made substantial purchases of commercial wheat. The slowdown can be attributed to our assumption of somewhat slower income growth and to price movements from 1973 to 1979 which favored increased wheat consumption. While both wheat and rice prices declined relative to nonfood prices during this period, the price of wheat relative to the price of rice dropped a total of 11 percent, or at an average annual rate of 1.8 percent.[27]

Preliminary data indicate that Indonesian imports reached 1.47 million tons in 1980. This is considerably above our projection for that year; and, in fact, projected imports for 1981 are still below 1980 levels. A large part of the discrepancy is due to the rapid buildup of stocks which occurred in 1980. Stockbuilding amounted to about 86,000 tons of grain and brought overall stock levels to 283,000 tons, an increase of 44 percent over the previous year. Adjusting for these changes, 1980 consumption of wheat flour in Indonesia amounted to 1 million tons, a level only 4.2 percent above that forecast. It is not known whether the stockbuilding effort was intentional or unintentional; but, in either case, such a rate of increase is not likely to be sustained in the future. This will have a dampening effect on imports in 1981.

U.S. exports to Indonesia could reach 764,000 tons by 1985 under a 40-percent market share assumption, or 1.15 million tons under a 60-percent share (table 14). This seems to represent a reasonable range, since the U.S. share fell from about 60

[27]Alternative projections based on the income and population assumptions used above and on a relative change in either wheat flour or rice prices, say a decline in wheat flour prices of 2 percent annually, can be obtained by adding the change in wheat imports due to the price change (table 15 of the following section) to total wheat imports in table 13.

**Table 13 — Projections for Indonesian wheat imports[1]**

| Projection | 1979 | 1980 | 1981 | 1982 | 1985 |
|---|---|---|---|---|---|
| | | *1,000 metric tons* | | | |
| 1. Base-period consumption | [2]878.4 | 878.4 | 878.4 | 878.4 | 878.4 |
| 2. Consumption increase due to population growth | — | 17.6 | 35.5 | 53.8 | 110.8 |
| 3. Consumption increase due to real income growth | — | 41.6 | 85.2 | 130.9 | 281.4 |
| 4. Consumption increase due to change in maize prices | — | 3.6 | 7.2 | 10.8 | 21.7 |
| 5. Total flour consumption | 878.4 | 941.2 | 1,006.3 | 1,073.9 | 1,292.3 |
| 6. Flour consumption in grain equivalents | — | 1,307.2 | 1,397.6 | 1,491.5 | 1,794.9 |
| 7. Addition to stocks | — | 15.7 | 32.0 | 54.3 | 115.0 |
| 8. Projected imports | — | 1,322.7 | 1,429.6 | 1,545.8 | 1,909.9 |

— = Not applicable.

[1]Since elasticities implied by equation 7 are constant and since our growth rate assumptions are fairly small, import projections can be obtained by adding the separate contribution arising from changes in each independent variable to consumption in the base period. Using actual consumption in 1979 as a base (the equation forecast consumption to be 844,000 tons), rows 2, 3, and 4 above indicate changes in consumption from the base period arising from population growth, per capita income growth, and changes in the relative price of maize, respectively. These changes are obtained by multiplying consumption in the base period by the assumed growth rate for the relevant independent variable and its elasticity. Row 5 is total projected flour consumption for the year. Row 6 is flour consumption converted to wheat grain equivalents using a conversion factor of 0.72. Row 7 shows the stock changes in grain equivalents needed to support the increase in consumption. Row 8 is the sum of rows 6 and 7 and shows projected imports for the year.

[2]Actual flour consumption in 1979 using a 72-percent conversion factor.

**Table 14 — Projected U.S. wheat exports to Indonesia**

| U.S. market share | 1981 | 1982 | 1985 |
|---|---|---|---|
| *Percent* | | *1,000 metric tons* | |
| 40 | 572 | 618 | 764 |
| 60 | 858 | 928 | 1,146 |

percent in the late sixties and early seventies to 40 percent during most of the remaining decade. This was caused by the cutback in P.L. 480 shipments and by the stiff competition which the United States faces from Australia in the Indonesian commercial market. P.L. 480 shipments climbed back to about 270,000 tons annually in the late seventies, but are unlikely to be above 100,000 tons in the near future and may be phased out altogether.[28] U.S. commercial sales to Indonesia, on the other hand, seem to be very price sensitive; in 1978/79, the U.S. share rose to 57 percent because of more favorable U.S. prices.

## Balance of Trade Impact of Encouraging Wheat Imports

Food policy in Indonesia must address a wide range of often competing objectives. Among these are achieving food self-sufficiency, improving the nutritional status of poorer segments of the population, stabilizing food prices, and creating employment opportunities. A full analysis of these issues from a perspective of formulating wheat policy would eventually lead us back to rice and require a comprehensive analysis of the total food sector. We are, therefore, limited to examining a narrower

[28]Because Indonesia began making commercial purchases of wheat only during the last decade, we were unable to econometrically test the proposition that there is a direct negative relationship between P.L. 480 shipments and U.S. commercial sales to Indonesia. It was found, however, that during the seventies, the United States on average captured 36 percent of the Indonesian market independently of P.L. 480.

set of objectives. Wheat is more widely traded internationally and can be obtained at a cheaper price than rice. Indonesia can thus reduce the foreign exchange cost of imported food as well as lessen its vulnerability to swings in the international rice market by replacing some of its rice imports with wheat imports. This section expands on these arguments in a very limited way by comparing two situations: lowering the domestic price of wheat versus raising the domestic price of rice.[29]

The respective impacts of these price changes ultimately depend on the size of the domestic rice and wheat markets and on various price and income elasticities of demand for both commodities. Since estimating a demand equation for rice is beyond the scope of this report, we rely on the work of Dixon (2) for the income (0.47) and own-price (-0.84) elasticities of demand for rice. The symmetry condition of demand theory is used to obtain a theoretical estimate of 0.045 for the cross-price elasticity of demand for rice with respect to wheat.[30] All other necessary parameters are obtained from equation 7 of table 12.

The impacts of either lowering wheat prices or raising rice prices by, for example, 2 percent per year can be analyzed in a fashion similar to that in the previous section. In the case of lower wheat prices, wheat consumption will be raised by approximately (2.0) x (1.78) = 3.56 percent per year and rice consumption lowered by (2.0) x (0.045) = 0.09 percent per year.

---

[29]An analysis similar to that below was suggested to the author and done theoretically by Amar Siamwalla at the International Food Policy Research Institute. In the discussion that follows, all price changes are made relative to the nonfood price index.

[30]The symmetry condition can be expressed in terms of elasticities as: $n_{rw} = s_w(n_{wr}/s_r + n_w' - n_r')$ where $s_r$ and $s_w$ are the shares of rice and wheat in total consumption; $n_{rw}$ and $n_{wr}$ are cross-price elasticities of demand; and $n_w'$ and $n_r'$ are income elasticities of demand. The shares are obtained by multiplying domestic food utilization of rice (16,970,000 tons) and wheat flour (878,000 tons) in 1979 by their respective retail prices (170.25 and 169.5 rupiah per kilogram) for that year, and by then dividing each by total consumption expenditure (18,123 billion rupiah on GNP accounts). The income elasticity of demand for rice is assumed to be 0.47 and all other parameter values are taken from equation 7 of table 12. After substitution, the cross-price elasticity of demand for rice with respect to wheat is found to be 0.045.

In the case of higher rice prices, wheat consumption will be raised by approximately (2.0) x (0.83) = 1.66 percent per year and rice consumption lowered by (2.0) x (0.84) = 1.68 percent per year. Table 15 shows the projected changes in wheat and rice imports after applying these growth rates to 1979 base period consumption levels (878,000 tons of wheat and 16,970,000 tons of rice) and after converting the wheat flour projections into wheat equivalents. For simplicity, we ignore possible changes in stock levels and any changes in rice supply which might result from the price changes.[31] The table also shows the net foreign exchange impact in 1979 dollars of encouraging more wheat imports, assuming c.i.f. prices for wheat and rice of $186 and $310 per ton, respectively, and assuming no change in the international price of either commodity.[32]

If the Government wishes to reduce the cost of imported food, it should do so by raising rice prices rather than lowering wheat prices (see final row of table 15).[33] Lowering wheat prices has the effect of increasing the cost of imported food because of the large increase in wheat imports (high own-price elasticity) and small decrease in rice imports (low cross-price elasticity). Operating directly on the domestic rice market, on the other hand, has the opposite effect. Even though the own-price elasticity for rice is about equal to the cross-price elasticity for wheat with respect to rice, rice imports are more affected by an own-price change because of the far greater domestic utilization of that commodity.

---

[31] The responsiveness of rice production to a change in rice prices is a controversial issue in Indonesia with considerable implications for food policy. To date, however, there have been few empirical studies on this issue and those completed suggest little, if any, price responsiveness. This may be due to problems, data and econometric, in isolating price from the host of other factors influencing rice production in a country as diverse as Indonesia. See Lains (6) for a recent attempt in this regard.

[32] The c.i.f. import price for rice is a unit value index based on 1979 BPS trade data. The price of wheat for 1979 is an average of the BULOG 1978/79 and 1979/80 c.i.f. import prices of $168.89 and $201.60 per ton, respectively.

[33] These results could be added to those in table 13 of the previous section in order to arrive at wheat import projections which incorporate the change in wheat or rice prices.

**Table 15 — Trade and foreign exchange impacts of a 2-percent annual decrease in wheat price and a 2-percent annual increase in rice price**

| Change in — | Units | Decrease in wheat price/increase in rice price | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1980 | | 1981 | | 1985 | |
| | | Wheat | Rice | Wheat | Rice | Wheat | Rice |
| Wheat: | | | | | | | |
| Imports | 1,000 tons | 43.4 | 20.2 | 88.4 | 40.8 | 284.8 | 126.6 |
| Value | Million dollars | 8.1 | 3.8 | 16.4 | 7.6 | 53.0 | 23.5 |
| Rice: | | | | | | | |
| Imports | 1,000 tons | -15.3 | -285.1 | -30.6 | -575.0 | -91.8 | 1,784.0 |
| Value | Million dollars | -4.7 | -88.4 | -9.5 | -178.2 | -28.5 | -553.0 |
| Net foreign exchange impact | do. | 3.4 | -84.6 | 6.9 | -170.6 | 24.5 | -529.5 |

There are several qualifications to the above results. First, they are highly sensitive to our estimated elasticities. It was found, however, that after constructing 90-percent confidence limits on the coefficients of equation 7, converting the boundary coefficients to elasticities, and then choosing those elasticities which are most favorable to a policy of lowering wheat prices, the net foreign exchange position still deteriorates.[34] Second, and more importantly, we have not considered the impact of declining Indonesian rice imports on international prices. The net foreign exchange cost in 1985 of lowering wheat prices is $24.5 million (table 15). Assuming that Indonesia imports 2 million tons of rice in that year, this foreign exchange cost would be offset if the international rice price falls from $310 per ton to $297.75 per ton. Given total world rice trade of 11.5 million tons, a 92,000-ton decrease in Indonesian rice imports is unlikely to result in such a large drop in international prices.[35] Thus, a policy of encouraging wheat imports by reducing wheat prices is unlikely to have a beneficial impact on the total cost of imported foods even when the movement in international prices is considered. A definitive answer to this question would, however, require a fuller examination of Indonesia's role in the international rice market.

Reducing the cost of imported food is but one of many possible goals of Indonesian policymakers. A few of the complexities of Indonesian food policy will become evident by putting this goal in some perspective. A policy of raising rice prices, aside from directly reducing rice demand and thus rice imports and imported food costs, might also stimulate domestic rice production. Such a policy, on the other hand, would have an immediate and detrimental impact on urban rice consumers and subject

[34]Confidence intervals on each coefficient of equation 7 were constructed using a t-value of 1.714 for a 90-percent confidence level with 23 degrees of freedom. The wheat elasticities chosen were -1.49 for own-price, 1.12 for cross-price with respect to rice, and 0.31 for income. The latter two elasticities imply, from the symmetry condition, a cross-price elasticity of rice with respect to wheat of 0.056.

[35]Such a drop in international prices would imply an international price elasticity with respect to Indonesian import demand of about 5.0.

the economy as a whole to added inflationary pressure. The latter has been of great concern to the present Government ever since the midsixties when it came into power partially on a mandate to contain spiraling inflation.

There may be strong political reasons for reducing Indonesia's reliance on the international rice market. But, the foreign exchange cost of imported food itself has not been a serious constraint on policymakers in recent years and is more a long-term consideration. Indonesia is somewhat less dependent on oil revenues than other OPEC countries, but petroleum still accounts for about 60 percent of the country's total exports. Recent OPEC price hikes have led to an oil windfall and by the end of 1980 foreign exchange reserves were over $7 billion.[36] By 1990, however, there is a real danger that Indonesia could become a net oil importer unless the current growth in domestic energy consumption is cut (*10*).

A policy of encouraging wheat imports raises additional issues over the long run. These are especially relevant should Indonesia's external position deteriorate and should the country achieve anything close to rice self-sufficiency. Nyberg argues that under such circumstances the Government's broader goals regarding income distribution and employment generation would be better served by meeting rice deficits over the next few years with rice imports (*8*). Otherwise a situation could arise in which a shift in policy, from one encouraging wheat imports to one of import substitution (domestic rice for imported wheat), is desirable. Such a policy transition would be made that much more difficult by the investments in the wheat milling and baking industries which would have occurred in the meantime.

More research beyond this study is needed before adequate policy recommendations regarding wheat can be made. Additional research might focus on: the distributional impacts of encour-

[36]There is also concern over the price distortions caused by Indonesia's use of its oil windfall for domestic subsidies. We do not consider this issue because it centers more on the domestic oil subsidy than on food subsidies.

aging the consumption of a commodity purchased primarily by higher income groups, the political and economic implications of Indonesia's role in the international rice market, the potential impact of wheat imports on the production of rice and other food commodities, and the employment implications thereof.[37]

[37]Examination of distributional impacts would also allow analysis of other policy mechanisms. For example, the Government could simultaneously raise rice prices and lower wheat prices so as to leave urban real incomes unchanged.

## References


1. Biro Pusat Statistik, *Proyeski Penduduk Indonesia 1976-2001*, Jakarta, 1978.

2. Dixon, John, "Consumption Research and the Role of Non-Preferred Staples," Unpublished manuscript, Ford Foundation, Jakarta. June 1979.

3. Eisner, Mark and Pindyck, Robert S., "A Generalized Approach to Estimation as Implemented in the Troll/1 System," *Annals of Economic and Social Measurement*, 211, 1973.

4. Farrar, D.E. and Glauber, R.R. "Multicollinearity in Regression Analysis," *Review of Economics and Statistics*, Vol. 49, 1967.

5. Kelch, David, "An Empirical Estimate of the Income Elasticity of Demand for Wheat as a Food Grain Using Cross-Country Data," Unpublished manuscript, Economics and Statistics Service, U.S. Department of Agriculture, 1980.

6. Lains, Alfian, "Regional Concentration in the Expansion of Rice Production in Indonesia," Unpublished Ph.D. dissertation, School of Economics, University of the Philippines at Diliman, 1978.

7. National Commission on Food Marketing, *Organization and Competition in the Milling and Baking Industries*, Technical Study No. 5, June 1966.

8. Nyberg, Albert J., "Food Policy — Import Substitution or Import Dependence," Paper prepared for the third biennial meeting of the Agricultural Economics Society of South East Asia, 27-29 November 1979, Kuala Lumpur, Malaysia.

9. Pan Asia Research and Communications Service, "The Report of Wheat Flour Research in Six Cities in Indonesia," Unpublished manuscript, Jakarta, 1980.

10. *Petroleum Economist*, "Growing Problems Downstream," Vol. XLVI, No. 11, November 1979.

11. Tabor, Steve, "SUSENAS V — Preliminary Evaluation of Consumption Trends and Nutritional Status," Unpublished manuscript, Economics, Statistics, and Cooperatives Service, U.S. Department of Agriculture, 1979.

12. Timmer, C. Peter, "Wheat Flour Consumption," *Bulletin of Indonesian Economic Studies*, Vol. VII, No. 1, March 1971.

13. Wheat Associates, U.S.A., "News from Wheat Associates Singapore," Various monthly issues.

14. *Wheat: Outlook and Situation*, Economics and Statistics Service, U.S. Department of Agriculture, WS-225, February 1981.

## Appendix table 1 — IWC data on Indonesian wheat imports

| Year | Wheat | Wheat flour | Total | Year | Wheat | Wheat flour | Total |
|---|---|---|---|---|---|---|---|
| | *1,000 metric tons*[1] | | | | *1,000 metric tons*[1] | | |
| 1950/51 | — | 116 | 116 | 1965/66 | — | 20 | 20 |
| 1951/52 | — | 244 | 244 | 1966/67 | 1 | 40 | 41 |
| 1952/53 | — | 140 | 140 | 1967/68 | 20 | 150 | 170 |
| 1953/54 | — | 217 | 217 | 1968/69 | 5 | 330 | 335 |
| 1954/55 | — | 132 | 132 | 1969/70 | 20 | 665 | 685 |
| 1955/56 | — | 231 | 231 | 1970/71 | 22 | 570 | 592 |
| 1956/57 | — | 279 | 279 | 1971/72 | 265 | 180 | 445 |
| 1957/58 | — | 153 | 153 | 1972/73 | 686 | 24 | 720 |
| 1958/59 | — | 113 | 113 | 1973/74 | 751 | 52 | 803 |
| 1959/60 | — | 186 | 186 | 1974/75 | 739 | — | 739 |
| 1960/61 | — | 162 | 162 | 1975/76 | 883 | 1 | 884 |
| 1961/62 | — | 152 | 152 | 1976/77 | 904 | 73 | 977 |
| 1962/63[2] | — | 90 | 90 | 1977/78 | 1,075 | 25 | 1,100 |
| 1963/64[2] | — | 25 | 25 | 1978/79 | 1,205 | 33 | 1,238 |
| 1964/65 | — | 20 | 20 | | | | |

— = Negligible.

[1]Grain equivalent.
[2]Listed import figures are different from those published in later issues of *World Wheat Statistics*. The figures published here are similar to what are reported by exporting countries.

Sources:
- 1950/51-1952/53: *World Grain Trade Statistics 1950-51/1972-73*, Foreign Agricultural Service, U.S. Department of Agriculture, September 1974, FAS M-258. July/June year.
- 1953/54-1978/79: *World Wheat Statistics*, International Wheat Council, various issues. July/June year.

**Appendix table 2 — Comparison of average annual Indonesian wheat imports by source of information**

| Period | Source | | | |
|---|---|---|---|---|
| | IWC[1] | IWC[2] | BULOG[3] | BPS[4] |
| | *1,000 metric tons*[5] | | | |
| 1953-60 | 184.1 | 182.9 | N.A. | 183.3 |
| 1961-67 | 74.0 | 85.0 | N.A. | 101.1 |
| 1968-72 | 555.4 | 561.4 | 502.5 | 505.3 |
| 1973-77 | 900.6 | 894.6 | 873.4 | 850.4 |

N.A. = Not available.

[1]Indonesian wheat imports reported by the International Wheat Council for July/June year (see App. table 1).

[2]Recorded exports to Indonesia reported by the International Wheat Council for July/June year. See table 4.

[3]April/March year. Assumes Indonesia imported 335,000 tons in 1968/69.

[4]Calendar year. Assumes Indonesia imported 1,075,000 m.t. in 1977. BPS reported imports for that year were 753,000 tons. See table 1.

[5]Grain equivalent.

## Appendix table 3 — Cross-sectional data

| Expenditure class | MEXP | WFCON | BBCON | BBCONR | QINDEX | FSIZE |
|---|---|---|---|---|---|---|
| All Indonesia: | | | | | | |
| 0-999 | 773.85 | 0.001 | 0.26 | 0.26 | 1 | 6.05 |
| 1000-1999 | 1613.5 | .002 | .66 | .58876 | 1.121 | 5.75 |
| 2000-2999 | 2501.9 | .004 | 1.86 | 1.4692 | 1.266 | 5.21 |
| 3000-3999 | 3467.1 | .008 | 3.98 | 2.7223 | 1.462 | 4.44 |
| 4000-4999 | 4469.5 | .018 | 7.02 | 4.2417 | 1.655 | 4.16 |
| 5000-5999 | 5458.7 | .027 | 10.57 | 5.7321 | 1.844 | 4 |
| 6000-7999 | 6869.2 | .05 | 16.15 | 7.8246 | 2.064 | 3.76 |
| 8000-9999 | 8877.3 | .074 | 26.4 | 10.806 | 2.443 | 3.52 |
| 10000-14999 | 11913 | .098 | 38.3 | 12.741 | 3.006 | 3.44 |
| 15000- | 21832 | .133 | 88.52 | 15.751 | 5.62 | 3.38 |

| | Urban sample | | Rural sample | |
|---|---|---|---|---|
| | MEXP | WFCON | MEXP | WFCON |
| Urban and rural Indonesia: | | | | |
| 0-999 | 798.2 | — | 773.24 | 0.001 |
| 1000-1999 | 1629.2 | 0.005 | 1612.9 | .002 |
| 2000-2999 | 2553 | .006 | 2497.1 | .004 |
| 3000-3999 | 3524.5 | .008 | 3456.9 | .008 |
| 4000-4999 | 4494.3 | .018 | 4463.3 | .019 |
| 5000-5999 | 5475.8 | .027 | 5453 | .027 |
| 6000-7999 | 6894 | .044 | 6857.5 | .053 |
| 8000-9999 | 8904.4 | .071 | 8859.3 | .077 |
| 10000-14999 | 11982 | .072 | 11854 | .119 |
| 15000- | 22808 | .117 | 19913 | .166 |

Definitions:

- MEXP — Mean per capita monthly expenditure for each expenditure class.
- WFCON — Weekly per capita wheat flour consumption in kilograms.
- BBCON — Weekly per capita bread and biscuit expenditure in rupiah.
- BBCONR — BBCON deflated by the cost of calorie index.
- QINDEX — Cost of calorie index. This index is based on the average price of a calorie for all food items covered by SUSENAS for which quantity consumption is recorded. For each such food item, the quantity consumed was converted to calories and divided into rupiah expenditure in order to derive the price of a calorie by income class for that food item. The index, which is set at 1 for the lowest income class, is based on the average of all such calorie prices.
- FSIZE — Average family size in Indonesia for each expenditure class. Family sizes for the "5,000-5,999" and "6,000-7,999" classes are linearly interpolated since SUSENAS provided an average family size for the "5,000-7,499" expenditure class only.

Data sources:

*Indonesia Survey Sosial Ekonomi Nasional Tahap Ke-Lima (Januari-Desember) 1976*, Biro Pusat Statistik, 1979.

- FSIZE — *Survey Pendudak Antar Sensus 1976, Keterangan Ekonomi Rumah Tangga*, Biro Pusat Statistik, Preliminary figures, 1977.
- BBCON — Biro Pusat Statistik, unpublished.
- QINDEX — See (*11*).

## Appendix table 4 — Time-series data

| Year | PWFJK | PRJK | PMJM | PCJM | PSJM | COLG | COLN |
|---|---|---|---|---|---|---|---|
| 1951 | 0.003 | 0.00245 | 0.00112 | 2.8E-4 | 0.00198 | 0.0211 | 0.0195 |
| 1952 | .00317 | .00265 | .00142 | 5.1E-4 | .00235 | .0228 | .0203 |
| 1953 | .00292 | .00268 | 9.3E-4 | 3.5E-4 | .00215 | .024 | .0225 |
| 1954 | .00329 | .00267 | 7.9E-4 | 2.9E-4 | .00262 | .026 | .0228 |
| 1955 | .0043 | .00314 | .00148 | 3.8E-4 | .00305 | .0322 | .0311 |
| 1956 | .00399 | .00425 | .00195 | 5.3E-4 | .00394 | .0356 | .0276 |
| 1957 | .00501 | .00527 | .00182 | 5E-4 | .00413 | .0402 | .0311 |
| 1958 | .0089 | .00883 | .0026 | 7.5E-4 | .00506 | .0584 | .0438 |
| 1959 | .01455 | .00789 | .00286 | 6.7E-4 | .00592 | .0738 | .0751 |
| 1960 | .01108 | .00907 | .0037 | 8.8E-4 | .01047 | .0979 | .1106 |
| 1961 | .01137 | .01503 | .00605 | .0019 | .01238 | .1224 | .0966 |
| 1962 | .03672 | .04535 | .01792 | .00698 | .03201 | .3384 | .2536 |
| 1963 | .11695 | .09075 | .0398 | .0112 | .07005 | .7556 | .6097 |
| 1964 | .43061 | .24046 | .0782 | .0245 | .13629 | 1.6373 | 1.2754 |
| 1965 | 1.6618 | .86392 | .26745 | .05895 | .50918 | 6.6395 | 4.9218 |
| 1966 | 18.08 | 7.092 | 2.66 | 1.22 | 5.79 | 76 | 67.34 |
| 1967 | 22.66 | 19.8 | 7.26 | 2.84 | 16.82 | 206 | 169.62 |
| 1968 | 42.05 | 54.14 | 19.11 | 7.26 | 38.09 | 464 | 328.89 |
| 1969 | 45.92 | 38.91 | 20.17 | 6.28 | 52.69 | 545 | 520.75 |
| 1970 | 43.91 | 45.75 | 19.6 | 8.08 | 52.72 | 612 | 615.46 |
| 1971 | 52.13 | 44.66 | 20.44 | 7.58 | 58.8 | 639 | 658.79 |
| 1972 | 58.09 | 52.26 | 27.32 | 9.8 | 65.68 | 680 | 660.95 |
| 1973 | 80.87 | 73.05 | 35.62 | 16.85 | 101.83 | 891 | 717.78 |
| 1974 | 79.76 | 81.65 | 46.73 | 13.46 | 128.07 | 1253 | 998.36 |
| 1975 | 100.14 | 102.61 | 56.91 | 17.55 | 164.79 | 1492 | 1152.5 |
| 1976 | 128.17 | 120.51 | 76.87 | 28.02 | 176.36 | 1788 | 1316.8 |
| 1977 | 130.19 | 126.97 | 77.92 | 29.15 | 197.29 | 1985 | 1474 |
| 1978 | 128.23 | 133.02 | 77.82 | 28.61 | 218.17 | 2146 | 1599.4 |
| 1979 | 169.5 | 170.25 | 103.92 | 33.34 | 292.69 | 2583 | 1929.3 |

See end of table for data sources and definitions.

**Appendix table 4 — Time-series data — Continued**

| Year | POP | GNPR | GNP | IMP | IMPWF | SCH | CONWF | DD |
|---|---|---|---|---|---|---|---|---|
| 1951 | 77974 | 2609 | 0.0623 | 177 | 127.44 | 0 | 127.44 | 0 |
| 1952 | 79535 | 2714.8 | .07 | 202 | 145.44 | 0 | 145.44 | 0 |
| 1953 | 81151 | 2885.9 | .0784 | 191 | 137.52 | 0 | 137.52 | 0 |
| 1954 | 82825 | 3088.6 | .0906 | 151 | 108.72 | 0 | 108.72 | 0 |
| 1955 | 84558 | 3193.6 | .1162 | 167 | 120.24 | 0 | 120.24 | 0 |
| 1956 | 86354 | 3295.8 | .1324 | 274 | 197.28 | 0 | 197.28 | 0 |
| 1957 | 88214 | 3537.4 | .1604 | 223 | 160.56 | 0 | 160.56 | 0 |
| 1958 | 90141 | 3432.5 | .2265 | 135 | 97.2 | 0 | 97.2 | 1 |
| 1959 | 92138 | 3477.7 | .2899 | 130 | 93.6 | 0 | 93.6 | 0 |
| 1960 | 94206 | 3502.2 | .387 | 197 | 141.84 | 0 | 141.84 | 0 |
| 1961 | 96323 | 3703.1 | .4651 | 153 | 110.16 | 0 | 110.16 | 1 |
| 1962 | 98322 | 3771.8 | 1.3261 | 87 | 62.64 | 0 | 62.64 | 1 |
| 1963 | 100239 | 3687.7 | 3.168 | 101 | 72.72 | 0 | 72.72 | 1 |
| 1964 | 102246 | 3817.1 | 7.0315 | 44 | 31.68 | 0 | 31.68 | 1 |
| 1965 | 104343 | 3858.7 | 23.537 | 45 | 32.4 | 0 | 32.4 | 1 |
| 1966 | 106530 | 3965.5 | 311 | 66 | 47.52 | 0 | 47.52 | 0 |
| 1967 | 108805 | 4020.7 | 838.2 | 212 | 152.64 | 0 | 152.64 | 0 |
| 1968 | 111171 | 4458.7 | 2067.9 | 510 | 367.2 | 0 | 367.2 | 0 |
| 1969 | 113629 | 4764.6 | 2683.4 | 408 | 293.76 | 0 | 293.76 | 0 |
| 1970 | 116175 | 5123.8 | 3289.9 | 557 | 401.04 | 0 | 401.04 | 0 |
| 1971 | 118689 | 5465 | 3605.3 | 620 | 446.4 | 32.4 | 414 | 0 |
| 1972 | 121107 | 5896.2 | 4404.6 | 431 | 310.32 | 4.9 | 305.42 | 0 |
| 1973 | 123529 | 6507.7 | 6507.7 | 692 | 498.24 | 46 | 452.24 | 0 |
| 1974 | 126000 | 6900 | 10201 | 786 | 565.92 | -60 | 625.92 | 0 |
| 1975 | 128520 | 7270.5 | 12087 | 731 | 526.32 | 10 | 516.32 | 0 |
| 1976 | 131090 | 7789.8 | 15034 | 968 | 696.96 | 21.9 | 675.06 | 0 |
| 1977 | 133712 | 8472.3 | 18332 | 1075 | 774 | 40 | 734 | 0 |
| 1978 | 136387 | 9045.9 | 21115 | 1154 | 830.88 | 4.3 | 826.58 | 0 |
| 1979 | 139114 | 9489.8 | 29337 | 1209 | 870.48 | -7.92 | 878.4 | 0 |

See data sources and definitions on next page.

Data Sources and Definitions for Appendix table 4

Except where otherwise stated, all data were obtained from the following sources:

- 1951-64 — *Indonesia Facts and Figures*, Nugroho, 1967.
- 1965-77 — *Buku Saku Statistik Indonesia* and *Statistik Indonesia*, Biro Pusat Statistik, various issues.

Rupiah data for the years 1964 and earlier have been converted to 'new' rupiah.

PWFJK = Retail price of 1 kilogram of wheat flour in Jakarta.

- 1951-52 — *Statistical Pocket Book of Indonesia*, Biro Pusat Statistik, 1960.
- 1967-76 — *Perkembangan Harga Bulanan Beras, Gula Pasir, Tepung-Terigu, Jagung dan Garam di Indonesia 1967 s/d 1976*, BULOG, 1977.
- 1977-79 — U.S. Agricultural Attache, Jakarta.

PRJK = Retail price of 1 kilogram rice in Jakarta.

- 1951-66 — Cheap quality rice. Based on percentage change in BPS series from 1967 back.
- 1967-76 — Medium quality rice. *Perkembangan Harga Bulanan Beras, Gula Pasir, Tepung-Terigu, Jagung dan Garam di Indonesia 1967 s/d 1976*, BULOG, 1977.
- 1977-79 — U.S. Agricultural Attache, Jakarta.

PMJM = Retail price of 1 kilogram of maize in rural districts of Java and Madura.

- 1978-79 — U.S. Agricultural Attache, Jakarta.

PCJM = Retail price of 1 kilogram of cassava in rural districts of Java and Madura.

- 1978-79 — U.S. Agricultural Attache, Jakarta.

PSJM = Retail price of 1 kilogram of soybeans in rural districts of Java and Madura.

- 1978-79 — U.S. Agricultural Attache, Jakarta.

COLG = General cost of living index in Jakarta covering 62 goods and services, September 1966 = 100. For the years 1963 and earlier, the index is based on percentage changes in the Jakarta cost of living index for a municipal workers' family of two adults and three children with a daily wage of f.1 in 1937. These percentage changes were then applied to the 1964 Jakarta cost of living index. In April 1979, the Jakarta cost of living index was replaced by a Jakarta consumer price index covering 150 goods and services. The 1979 level of COLG was estimated by applying monthly percentage changes in the new CPI to the March 1979 level of the old cost of living index. See *Statistik Ekonomi — Keuangan Indonesia*, Bank of Indonesia, 1980.

COLN = Nonfood cost of living index in Jakarta, September 1966 = 100. The index was calculated by removing food from the general cost of living index using constant weights of 0.72 for the years before 1963, 0.634 for the years 1964 to 1978, and 0.398 for 1979. Because of the different weights, breaks in the series occur in 1964 and 1979. The actual index was calculated using percentage changes in a fashion similar to COLG.

POPR = Midyear population of Indonesia in thousands. The midyear estimates are calculated as simple averages of end-year estimates.

- 1951-60 — *Statistical Pocketbook of Indonesia, 1964-1976*, Biro Pusat Statistik.
- 1961-70 — *Buku Saku Statistik Indonesia, 1977-1978*, Biro Pusat Statistik.
- 1971 — A September estimate was calculated by adding the rural population of Irian Jaya (estimated at 770,000) to the September census estimate of 118,368,000. This estimate was then converted to an end-of-year figure by assuming a 2.1-percent growth rate for 16 weeks.
- 1972-79 — End-of-year estimates were calculated by assuming a constant 2-percent growth in population after 1971. This growth rate reflects revisions in Indonesia population estimates from the 1976 intercensus population survey.

GNPR = Indonesian gross national product in billions of 1973 rupiah.

- 1951-59 — *Rice Storage, Handling and Marketing, The Republic of Indonesia*, Weitz-Hettelsater Engineers, 1972.
- 1977-79 — *International Financial Statistics*, International Monetary Fund. Assumes that the growth in GNPR was the same as that for real GDP.

GNP = The nominal gross national product of Indonesia in billions of rupiah.

- 1951-59 — No data on nominal GNP could be obtained. GNP was estimated by applying changes in COLG to GNPR.
- 1977-79 — *International Financial Statistics*. International Monetary Fund.

IMP = Imports of wheat and wheat flour in 1,000 tons wheat grain equivalents. See table 1.

IMPWF = Imports of wheat and wheat flour in 1,000 tons flour equivalents. IMPWF = 0.72 x IMP.

SCH = Year-end stock changes in 1,000 tons flour equivalents.

- 1971-76 — *Neraca Bahan Makanan di Indonesia*, Biro Pusat Statistik, various issues.
- 1977-79 — U.S. Agricultural Attache, Jakarta, including stocks held at mills.

CONWF = Consumption of wheat flour in 1,000 tons. CONWF = IMPWF - SCH.

DD = Dummy variable for years of political turmoil.

☆ U. S. GOVERNMENT PRINTING OFFICE : 1981 522-005/3454

## Economic Research Service

The Economic Research Service carries out research on the production and marketing of major agricultural commodities; foreign agriculture and trade; economic use, conservation, and development of natural resources; trends in rural population, employment, and housing; rural economic adjustment problems; and performance of the U.S. agricultural industry. ERS provides objective and timely economic information to farmers, farm organization members, farm suppliers, marketers, processors, consumers, and others who make production, marketing, and purchasing decisions, and to legislators and other public officials at the Federal, State, and local government levels.

United States
Department of Agriculture

Washington, D.C.
20250

OFFICIAL BUSINESS
Penalty for Private Use, $300

Postage and Fees Paid
U.S. Department of Agriculture
AGR-101

THIRD CLASS MAIL